BRITISH SCHOOL OF ARCHAEOLOGY IN JERUSALEM

RESEARCHES IN PREHISTORIC GALILEE

BY

F. TURVILLE-PETRE, B.A.

1925-1926

AND

A REPORT ON THE GALILEE SKULL

BY

SIR ARTHUR KEITH, F.R.S., F.R.C.S., ETC.

A

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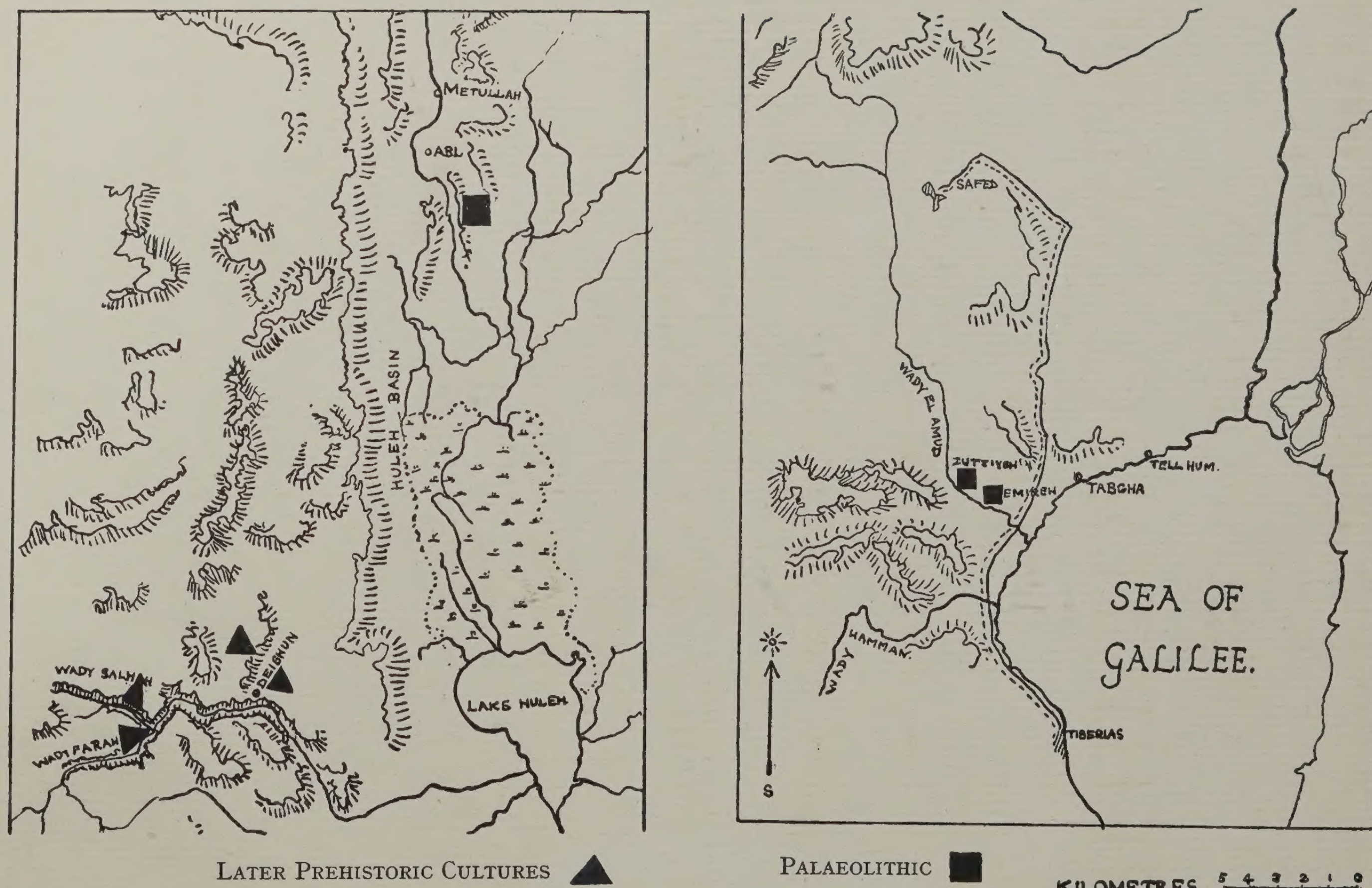

MAP OF THE LAKE HULEH AND PLAIN OF GENESERETH DISTRICT

Frontispiece

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F. TURVILLE-PETRE, B.A.

WITH SECTIONS BY DOROTHEA M. BATE AND CHARLOTTE BAYNES

AND

A REPORT ON THE GALILEE SKULL

BY

SIR ARTHUR KEITH, F.R.S., F.R.C.S., ETC.

1927

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PREFACE

THIS Special Publication contains a detailed report on the field-work of the School during the Spring seasons of 1925 and 1926, of which a brief account was given in Bulletin no. 7. As it had been decided to take the opportunity which offered of examining caves in Galilee in search of prehistoric remains, the local operations were placed under the direct charge of Mr. Turville-Petre, who, while still at Oxford, had made a special study of the Stone Age, and had, during a previous season, made a preliminary exploration of the area (as described in Bulletin no. 3). He contributes the leading descriptions of the explorations effected and the caves excavated. Mrs. Baynes, who joined the School specially for this work, seconded him assiduously throughout, and contributes some Geological Notes. Mr. FitzGerald, Mr. Crouther-Gordon, and Mr. G. E. W. Avory also took their share, so far as their special studies permitted, in the practical work, and gained a helpful insight into the methods of this special field of research.

We are happy in having secured expert collaboration in this publication. Miss Dorothea Bate, of the British Museum, who visited the caves, has scrutinized all the fossilized remains, and after mature study contributes important sections on the fauna. Sir Arthur Keith, Conservator at the Royal College of Surgeons, has made an exhaustive comparative study of the fossilized human skull fragments, and has written the detailed report thereon which appears in Section IX.

This discovery of Stone Age implements, fauna, and human remains is not only encouraging to the School, but opens wide the door to this field of prehistoric studies, which cannot fail to attract new students and to throw further welcome light on the early history of man in Palestine.

The Council are once again indebted to their Hon. Treasurer, Mr. Robert Mond, for making it possible to publish and illustrate adequately this complete Report.

JOHN GARSTANG
Director.

30th June 1926.

CONTENTS

LIST OF PLATES

LIST OF ILLUSTRATIONS

SECTION I

INTRODUCTION

THE fertile plain known to the Arab as El-Ghuweir, the Low Land, and to the Biblical student as the Plain of Genesereth, begins at the Jewish colony of Mejdel, some five kilometres north-west of Tiberias; to the north it is separated from the small plain of Et-Tabgha by the hill El-Oreimeh; to the east it is bounded by the Sea of Galilee; to the west by the Galilean Highlands. Its greatest length from north to south is some five kilometres, its greatest breadth from east to west two and a quarter kilometres. Three streams cross the plain to the lake; the valleys through which they flow, beginning with the southernmost, are known as the Wadi Hammam, the Wadi Rubudiyeh, and the Wadi el 'Amud. In the extreme north-east corner of the plain is the naturally warm spring 'Ain Tine, so that in a country so desiccated as Palestine, the plain may be said to be extremely well watered. In general the region is particularly well suited to the requirements of man in a hunting stage of culture; the lake offers a plentiful supply of fish; wild game no doubt formerly abounded, and there is no lack of caves and shelters in the limestone hills which form the Highlands of Galilee.

During the years 1909-11, Dr. Paul Karge, of Munster University, surveyed the plain and surrounding hill country in search of prehistoric sites; the results published in his work *Rephaïm*[1] show that the district must have been thickly populated during the later prehistoric, *i.e.*, Neolithic and Bronze Age, periods. He describes particularly the necropolis of Kerazeh, which contains more than three hundred dolmens and lies some six and a half kilometres north-east of the plain; the megalithic village of Shegerat el Mubarakat; the fortified summit of the hill Kurun Hattin; and the rich deposit of flint implements of Neolithic type to be found on the slopes of Oreimeh and along the lake shore immediately north of the landing-stage at Et-Tabgha. Karge also investigated a cave site, the Mugharet-el-'Abed, near Dibl, in the extreme north of Galilee, where he found a number of worked flints suggesting a late Palaeolithic occupation, but was unable to establish the existence of any palaeolithic sites in the immediate vicinity of the Genesereth plain.

[1] *Rephaïm. Die vorgeschichtliche Kultur Palästinas und Phöniziens.* Paderborn, 1917.

Nevertheless, it seemed improbable that the extensive Middle and Late Palaeolithic cultures discovered by Zumoffen in the Lebanon caves had not spread southwards into Palestine, following the comparatively easy route of the Jordan valley, and the present writer, while investigating prehistoric sites in Palestine in the spring of 1923, decided to make the hills bordering the plain of Genesereth the centre of his researches, and to devote particular attention to caves.

Of the many valleys which break these hills, one in particular, the Wadi el 'Amud, appeared likely to contain early settlements. This valley has been cut by a stream which rises in the vicinity of Safed, runs for ten kilometres due south, then takes a sharp turn to the east and after a further four kilometres finally empties itself into the Sea of Galilee. During most of its course the sides of this valley are so precipitous as to form a true ravine, but the gorge ends abruptly two kilometres after it has taken its turn to the eastward, and for the last two and a quarter kilometres of its course the stream flows across the open plain.

F. Turville-Petre.

SECTION II

EXCAVATION OF THE PALAEOLITHIC CAVE MUGHARET-EL-EMIREH, 1925

BY F. TURVILLE-PETRE

A HUNDRED metres outside the entrance to the ravine stands a limestone bluff among the first of the foothills which delimit the plain; this escarpment, which faces south-east, lies some hundred metres to the north of the stream, and dominates the surrounding flat country. In its face are three small rock shelters known locally as the Mugharet-el-Emireh (Plates Ia and IIb). Taking these shelters in order, west to east, their dimensions are approximately 8 m. broad, 5.70 m. deep, and 10 m. high; 5.70 m. broad, 3 m. deep, and 2 m. high; and 2.70 m. broad, 2.70 m. deep, and 1 m. high. Of these the last is too small to have been at any time inhabited, and in fact the deposits it contained were sterile and did not exceed 10 cm. in thickness. Immediately to the west of this shelter is a well worked cup mark, measuring 26 cm. across and 21 cm. deep. The middle cave of the three, though smaller than that to the west, is better protected from the weather and more suited to permanent habitation. A preliminary investigation in 1923 showed that a natural corridor opened out of the back of this cave. Though this corridor was filled nearly to the roof with debris, it was possible to penetrate to a distance of some five metres, where a number of fragments of worked flints were found lying on the surface, and on this evidence of occupation it was decided to undertake a systematic excavation of the cave.

Excavations were begun at the end of April, 1925, by digging a trench (Trench A) from the back wall, across the cave and out on to the terrace. Inside the cave and immediately outside the entrance this trench was dug down to bed rock, which was reached at a depth of about 110 cm. below the modern floor level. At a distance of two metres outside the entrance, however, enormous blocks of fallen rock made it impossible to continue the trench. The excavation of this trench showed that the deposits inside the cave, below a recent crust layer of goat dung, had been completely disturbed and contained fragments of pottery datable to various periods

ranging from the Early Bronze Age to the present day, together with a number of worked flints of Late Palaeolithic type. Seeing that the crust layer on the terrace immediately in front of the cave yielded a similarly mixed collection of objects, it would seem that at some period the cave had been cleared of the debris which had accumulated in it, to make room for later occupants, and the refuse thrown out on to the terrace. The area of disturbance was, however, confined to the interior of the cave. On the terrace in front, two layers were clearly distinguishable (Plates Ib and IIa); (1) a crust layer varying from 25 to 50 cm. in thickness and containing large blocks of fallen rock, worked flints of Late Palaeolithic type, and pottery of all ages from Neolithic to the present day, (2) a dry clayey layer, about 70 cm. in thickness, practically free from stones and containing worked chert implements, and a considerable quantity of highly mineralized bone. The interior of the cave was cleared to rock, but owing to their disturbed nature the deposits were without interest. In a recess at the north-east corner of the cave were traces of a late Roman burial, including some human long bones and fragments of a large jar of ribbed ware. In the original rock floor, towards the back of the cave, was a natural hole some 2 m. deep; this hole contained no pottery and seems not to have been affected by the disturbance of the rest of the cave; it contained large quantities of broken flint and broken bone, but scarcely any worked implements, and seems to have been used as a refuse hole by the earliest inhabitants of the cave.

The terrace immediately in front of the cave was next cleared, and showed, as already indicated by trench A, that below a mixed crust layer, which included large blocks of fallen rock, was a homogeneous, clayey layer, extremely dry, with a tendency to harden, representing a palaeolithic occupation level. This deposit, which averaged 70 cm. in thickness immediately in front of the cave, extended down to bed rock, or was in places separated from it by a layer of fine reddish earth 5 to 10 cm. thick. The clay deposit was removed in three layers (50-75 cm., 75-100 cm., and 100-120 cm.) and was found to contain numerous worked chert implements, waste flakes, cores, and quantities of mineralized bone thickly encrusted with a calcareous deposit. Potsherds and other intrusions from a higher level were entirely absent. A small recess in the outer face of the cave wall to the east of the entrance seems to have been used as a hearth; the clay was here considerably hardened by heat and many of the bone and flint implements showed signs of charring.

At a distance of about four metres outside the cave entrance the clay layer began to diminish rapidly in thickness and practically disappeared at about six metres.

Attention was next turned to the natural passage into the rock which opened out of the back of the central cave. This passage was divided into four small

chambers, connected one with another by arch-like entrances so low that before the removal of the accumulated earth it was only just possible to crawl through them. The black cave earth which formed the main part of the deposit in the passage averaged 50 cm. in thickness, and showed no sign of layers; below the black earth was a thin layer of yellowish, clayey earth, merging into a gritty white layer of decomposing rock. The black earth, when removed, was found to contain quantities of worked chert and waste flakes, together with fragments of bone in a mineralized condition, which in many cases showed signs of charring and artificial breakage. In addition, there were considerable quantities of bone in a soft, non-mineralized condition; it would seem that the passage had been used in recent times as a lair by beasts of prey, which had disturbed the deposits and introduced the non-mineralized bone fragments; this would account for the fact that the palaeolithic remains did not occur in a definite layer, but were scattered throughout the deposits. While there is thus no stratigraphical evidence on which to date the remains found in the passage, there can be little doubt that they may be regarded as contemporary with the lower deposit on the terrace in front of the cave. The implements are wholly analogous in form and technique, and though the mineralized bone from the passage is not encrusted with a calcareous deposit as is that from the lower layer on the terrace, the difference is sufficiently accounted for by the dissimilarity of the conditions to which the two have been subjugated. In the case of the two inner chambers, strong corroborative evidence for the early date of the flint and bone remains is to be found in the almost complete absence of pottery fragments from these chambers. Four small fragments of Byzantine ware, together with nine small fragments of Bronze Age and one of Neolithic ware, all extremely water-rolled, constituted the entire number of potsherds found in these chambers.

The two chambers nearer the main cave lay to a considerable extent within the area of disturbance and contained a considerable number of pottery fragments.

Next the shelter to the west of the central cave was similarly cleared to rock. Two trenches, B and C, were first dug to determine the succession of deposits which were then removed in layers. Below a crust deposit containing a miscellaneous collection of objects of all dates, was a clay layer containing chert implements and bone fragments similar to those found in the clay layer in front of the central cave; the bone was similarly encrusted with lime, but rather less thickly. Owing to the extreme irregularity of the rock floor in this area, the layers were of very variable thickness; the crust layer never exceeded 20 cm. in thickness, the clay layer attained a thickness of 50 cm. along a fissure in the rock floor, but in general averaged about 25 cm.

Three trenches, D, E, and F, were dug on the slope leading up to the cave. Here again the clay deposit containing chert and mineralized bone was found beneath a crust layer, but the chert consisted almost entirely of waste fragments, and as none of this lower slope seemed to have lain within the true habitation area, it did not seem necessary to excavate it completely.

From the above account, it will be seen that only in the lower deposit on the terrace outside the main cave and in the floor of the shallow shelter to the left, were palaeolithic deposits discovered in an undisturbed state, consequently, it is mainly from the implements found in these two areas that we must establish the type series characteristic of the palaeolithic culture here represented. Hence in the catalogue of implements which follows, and in the plates, almost all the implements shown were either derived from these areas, or are wholly similar in form and technique to those there found; in cases where implements of exceptional form derived from the disturbed deposits are shown, the fact is expressly stated. Nevertheless, it is extremely probable that the very great majority of implements, whether from undisturbed deposits or not, are of palaeolithic date, for no implements showing a typical neolithic technique anywhere occurred, so that it is improbable that the cave was ever occupied by a flint-using people subsequent to palaeolithic times.

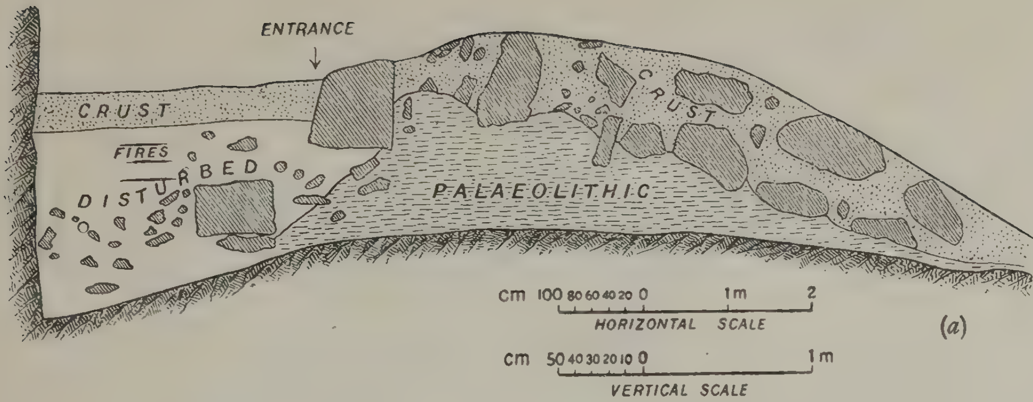
It will be noticed that typologically the implements seem to include forms analogous to the Aurignacian of Europe, together with some of a characteristically Mousterian technique; it must be clearly stated that these two types occurred intimately mingled, both in front of the main cave and in the shelter to the west, in what had every appearance of being undisturbed layers.

A

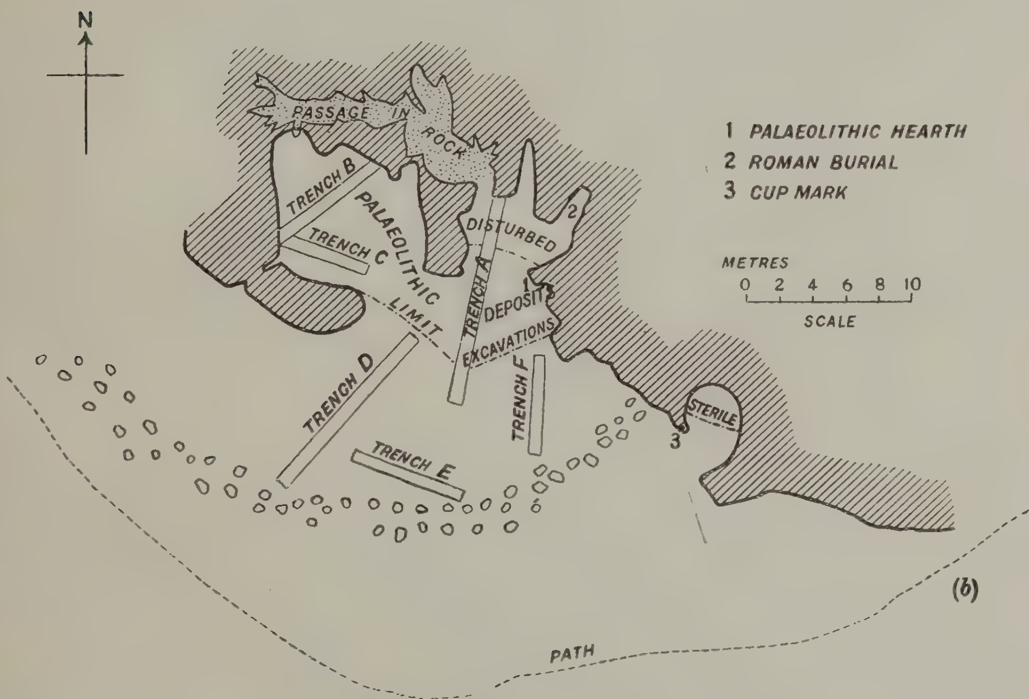
B

MUGHARET-EL-EMIREH.

(a) General view of rock shelters.
(b) Section through deposits at entrance to main cave.



(a)



(b)

Mugharet-el-Emireh

(a) Section through deposits on floor of main cave.
(b) General ground plan of caves.

SECTION III

CATALOGUE OF THE IMPLEMENTS FROM THE MUGHARET-EL-EMIREH

Points (Plate III). The points from this cave show a variety of types not usually associated in European sites, and taken together with the other implements from the cave seem to show a clear mixture of Middle and Late Palaeolithic techniques.

Thus figs. 1-7 are typical Mousterian points; figs. 10 and 11 tend towards the Audi type. Figs. 14, 15, and 16 suggest the three main types in the development of pointed implements in the European series, and correspond respectively to the Audi, Chatelperron, and Gravette types.

Side Scrapers (Plate IV, figs. 1-10). Here again the Mousterian characters in the culture are clearly marked. Figs. 1-3 are typical Middle Palaeolithic side scrapers; the steepness of the scraping edge in figs. 4, 5, and 6 is more suggestive of a Late Palaeolithic technique. The implements shown in figs. 7-10 seem to be intermediate in form between the Mousterian point and the side scraper.

Discs of the usual type are shown in Plate IV, figs. 11-15.

End Scrapers (Plate V). The implements shown on this and the following plates would seem to establish the predominantly Late Palaeolithic nature of the Emireh culture, in spite of the presence already noted of a large number of Middle Palaeolithic forms. Single end scrapers, figs. 1-15, common at all periods from the Late Palaeolithic onwards, are extremely rare earlier, and this is still more definitely the case with the double end scrapers, figs. 16-21.

The square end scraper, fig. 23, was not derived from a defined layer, but from the disturbed area inside the main cave, but technologically it seems to belong to the same culture as the rest of the implements.

The extremely rare implement (fig. 24), with a finely serrated edge, was found in the crust layer immediately in front of the main cave. An almost precisely similar implement is figured by J. de Morgan from Chabet Rechada, Tunisia.[1]

[1] *La Préhistoire Orientale*, p. 281, fig. 48. Paris, 1925.

Nosed Scrapers (Plate VI, figs. 1-5) are of the type well known in European Late Palaeolithic deposits.

Core Scrapers (Plate VI, fig. 6) of an ordinary conical form, and keeled core scrapers, figs. 7-10, were fairly common.

Fig. 11 is an unusual form, it seems to have been intended for a scraper, one end having been roughly retouched.

Flakes with a serrated edge, as fig. 12, were very rare.

Fig. 13 shows the only true graver found at this site.

Fig. 14 shows a core from which long flakes have been detached.

Microliths. The extremely small implements reproduced on Plate VII are shown in natural size, instead of being reduced to one-half as is the case in the other plates. Figs. 1-10 are long narrow points, in some cases, as figs. 2, 5, 6, and 9, minutely retouched along both edges.

Fig. 11 has been retouched along one edge, the other being left in its naturally sharp state. Fig. 12 has a regular serrated edge.

Figs. 13-21 are minute end scrapers, differing in nothing except size from the larger end scrapers found in the cave.

Bone. The two fragments shown in figs. 22 and 23 are the only specimens of worked bone found, they are from the disturbed deposits in the passage opening out of the back of the main cave, and so cannot be absolutely dated, but in view of the absence here of later objects of human workmanship, it seems probable that they are of palaeolithic date.

Human remains. A very small fragment of a human skull was found in the palaeolithic layer in front of the main cave. This has been identified by Sir Arthur Keith as coming from the hinder end of the right parietal bone; it is probably from a skull of the modern type, but is too small to allow of any inferences being drawn from it.

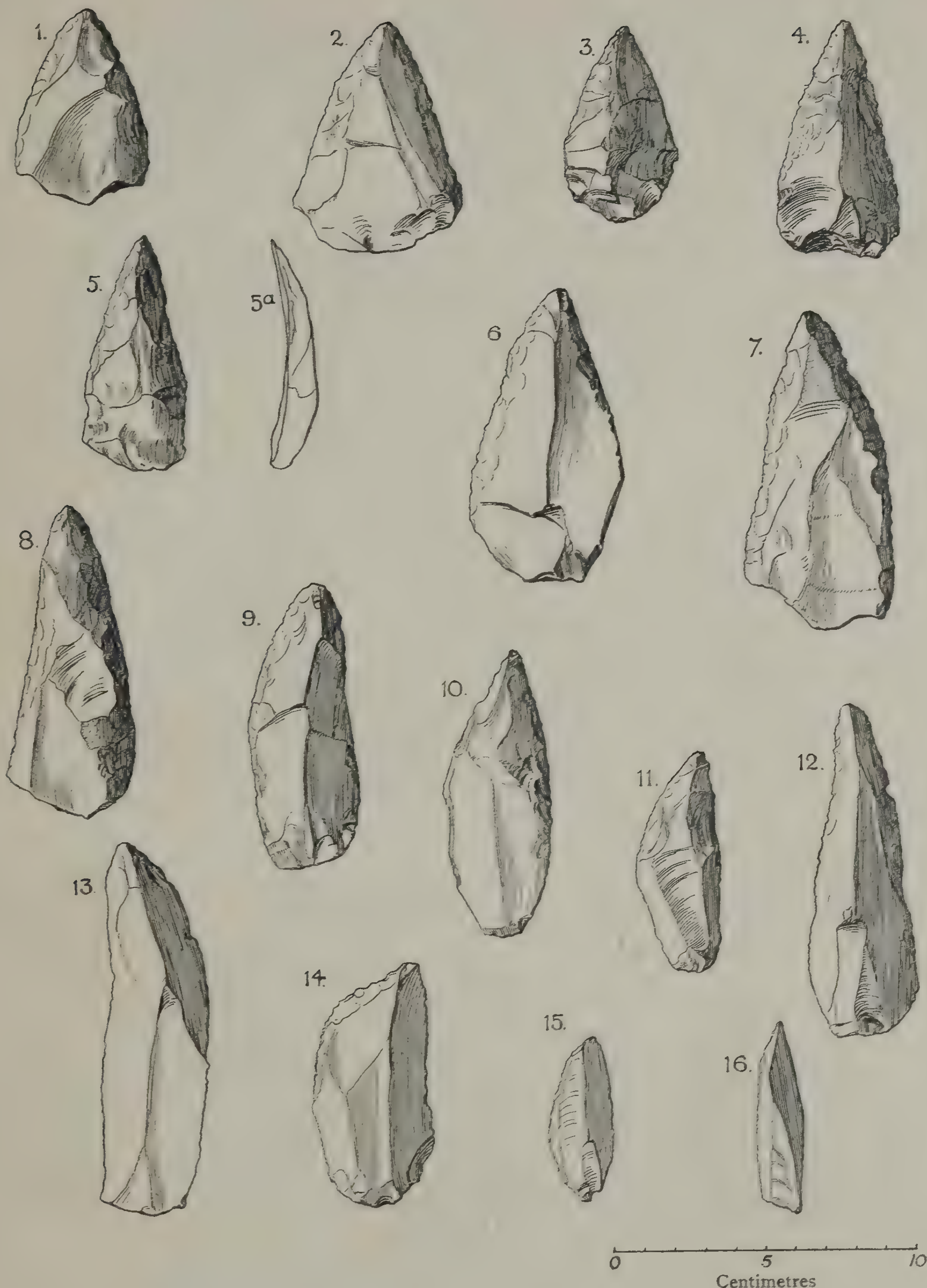

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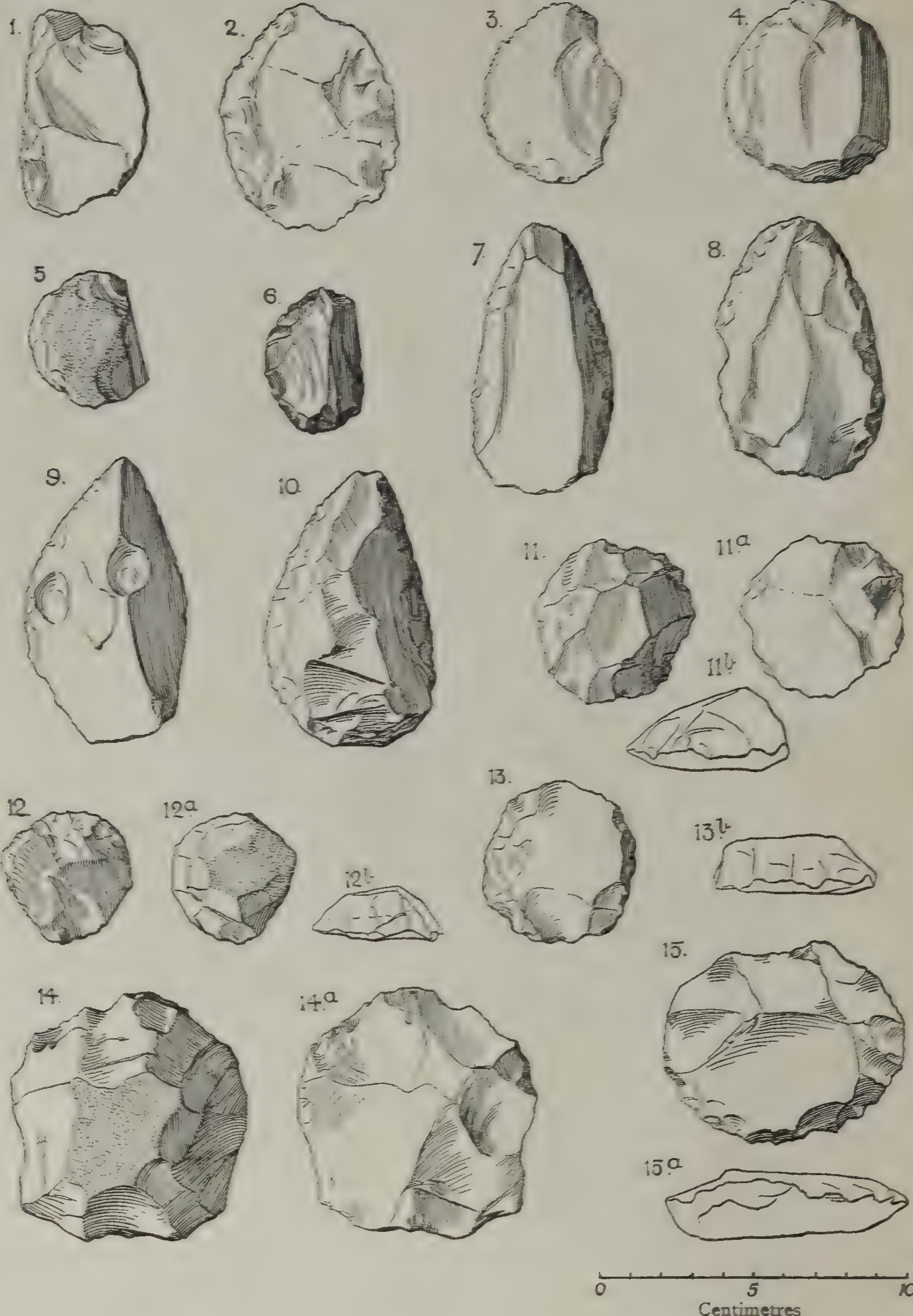
PLATE IV



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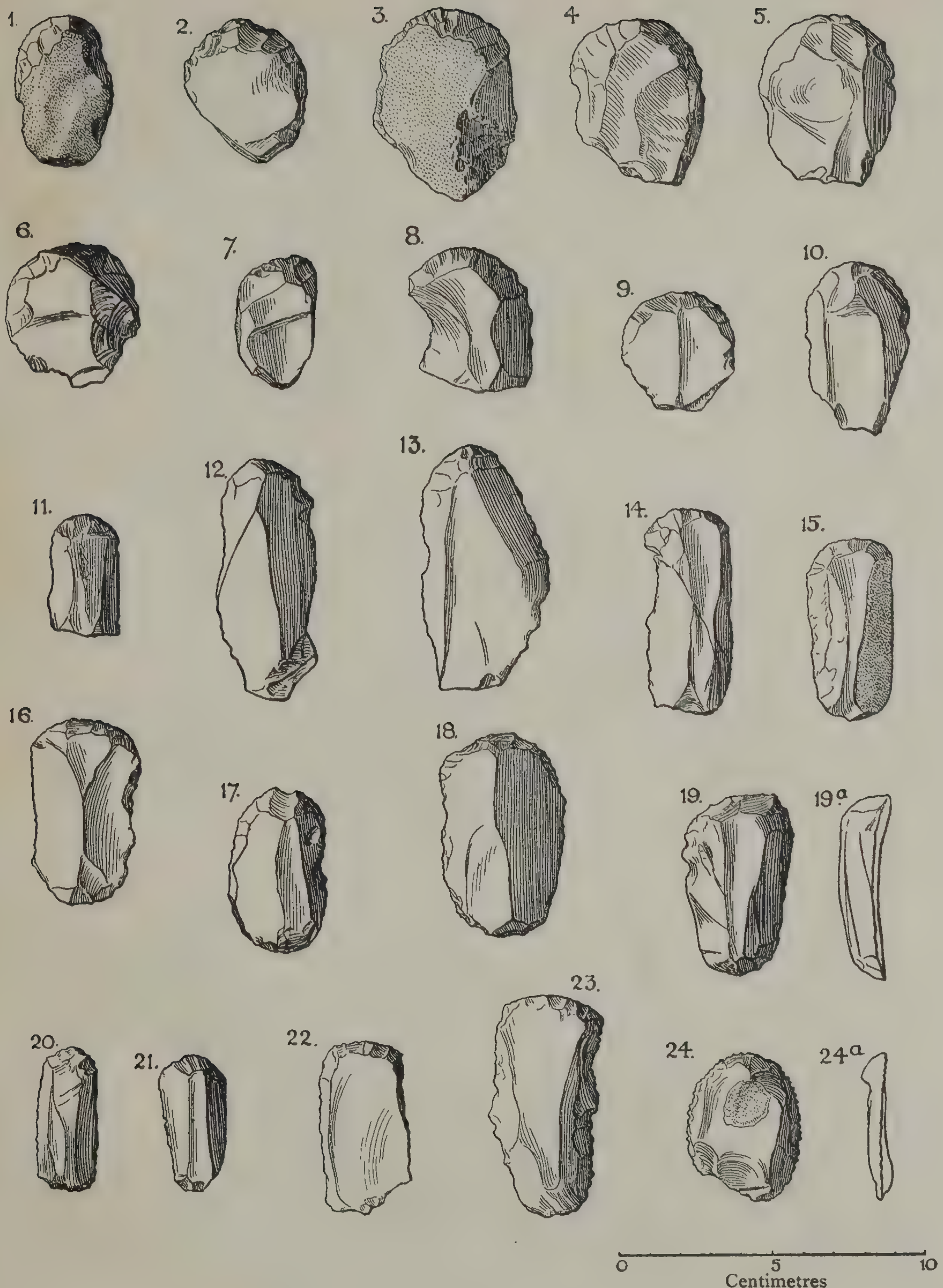
Centimetres

PLATE V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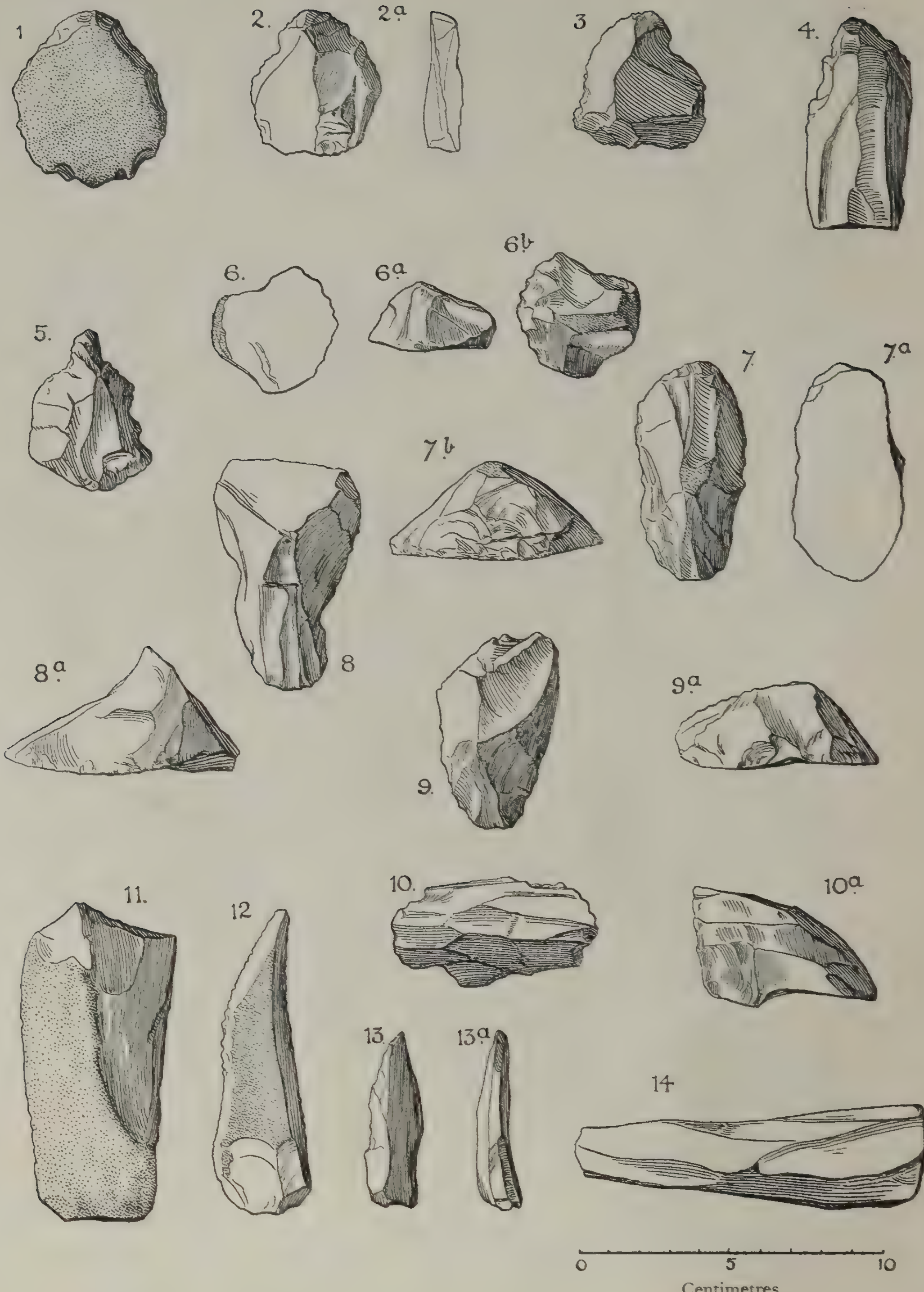
Centimetres

PLATE VI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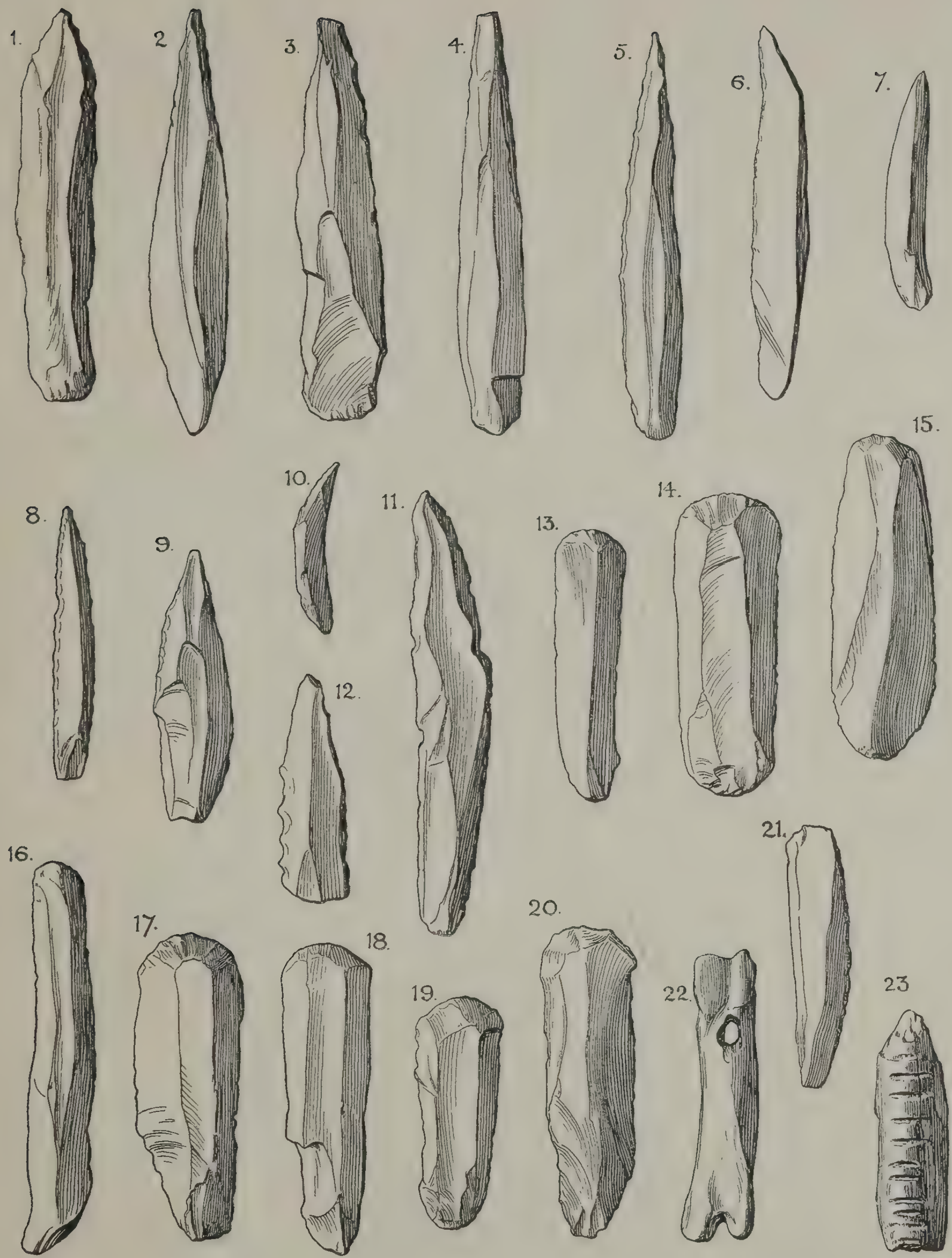
Centimetres

PLATE VII



0 1 2 3 4 5
Centimetres (Natural Size)

SECTION IV

ON THE ANIMAL REMAINS OBTAINED FROM THE MUGHARET-EL-EMIREH IN 1925

By Dorothea M. A. Bate

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THE material described in the following notes was obtained during the excavation of the Emireh Caves in 1925. The specimens were all associated with Palaeolithic flint implements, which seem to be of late Middle Palaeolithic, or Early Aurignacian types, perhaps indicative of a transitional stage between Middle and Upper Palaeolithic. As already described in this volume, some are from an undisturbed layer immediately in front of the main cave, while others are from a disturbed layer inside.

The animal remains obtained from this disturbed layer were of mixed character and included some bones of apparently recent introduction. Among them are bones and teeth of ox, deer, goat, horse, porcupine, and of two carnivores, one of which seems to have been a dog considerably smaller than a wolf.

The specimens from the undisturbed layer are all covered with a thin encrustation of a very hard, earthy, calcareous deposit. Unless otherwise stated, all the remains noted below are from this undisturbed layer. Besides those of recent introduction, remains of eight species of mammals were obtained, three of these, *Lepus* sp., *Camelus* sp., and *Rhinoceros hemitoechus*, were not included in the collections from the Zuttiyeh cave.

A few land shells occurred in the undisturbed layer and these have been identified by Mr. L. R. Cox as *Helix* (*Levantina*) *caesareana* Parreys, a species still common in Syria.

1. *Lepus* sp.

The distal portion of a left humerus of a hare was obtained from the disturbed layer, but is mineralized and is somewhat similar in colour to the remains from the Zuttiyeh cave.

Several species of hare are found in Palestine, but it is impossible from this single fragment to say if it corresponds with the humerus of a recent species or not.

2. *Camelus* sp. (Text-fig. 1.)

A single imperfect last upper premolar of the left side agrees with that of a camel. It is in an advanced stage of wear with most of the internal crescentic lobe broken away.

The occurrence of remains of a camel is interesting as very little is known of this animal in Europe and the Mediterranean region during the Pleistocene period. Remains of several species have been recorded from Southern Russia, Roumania and Bessarabia, and Algeria.

Another interesting point is the association of a camel with *Gazella*, a large *Bos*, *Equus*, and *Rhinoceros*, an assemblage that certainly gives no indication of desert conditions. In Algeria P. Thomas (1884, p. 38)[1] found camel remains with those of *Elephas*, *Hippopotamus*, and buffalo, while Nehring (1901) describes his *Camelus*

FIG. 1. *CAMELUS* SP. LAST UPPER PREMOLAR, NATURAL SIZE.

knoblochi from Sarepta on the Lower Volga as associated with *Elasmotherium*, *Elephas primigenius*, *Bison*, *Cervus giganteus*, and *Equus*.

In historic times the Camel seems to be only doubtfully known as a wild animal, those now found wild in Chinese Turkestan and Mongolia being possibly descendants of domesticated herds (Lydekker, 1915, p. 300).

3. *Cervus* sp.

An imperfect lower molar of a deer probably belongs to a species of the *C. elaphus* group. Besides this tooth there are a few fragmentary portions of limb bones representing ruminants of two sizes; the larger bones probably belong to this deer, and the smaller bones to the goat mentioned below.

[1] A list of works referred to will be found on p. 51.

4. *Gazella* sp.

The remains of gazelle include a few fragmentary limb bones and three imperfect mandibular rami which show most of the cheek teeth. A slight difference in size and in the structure of the fourth premolar suggests that more than one species is represented, the smallest being identical with, or closely allied to, the form of *G. arabica* still found in Palestine.

5. *Capra* sp.

The base of a horn-core nearly 13 cm. in circumference may represent *Capra nubiana*, the Arabian ibex, which was commonly found in Palestine until quite recently. As mentioned above, there are a few portions of limb bones which may also belong to a species of *Capra*.

FIG. 2. *EQUUS* SP. UPPER SECOND PREMOLAR, NATURAL SIZE.

6. *Bos or Bison.*

A large bovine is represented by three second lower molars only slightly worn, a fragmentary upper molar, and a right astragalus. The maximum height of the single lower molar of the left side is 66 mm. and the antero-posterior length 38 mm.

The material is insufficient to show whether it should be ascribed to *Bos* or *Bison*. Comparison of the molars with the corresponding teeth in recent or in Pleistocene Bison, shows that they are rather larger, particularly in antero-posterior length; on the other hand they agree closely with some of the specimens of *Bos primigenius* in the British Museum. An upper molar of similar large size obtained from a cave deposit near Beirût by the late Mr. E. R. Billington (B.M., M 12951) may also belong to *Bos primigenius*.

The astragalus is very like that of *Bison* and the smaller examples of this bone in *Bos primigenius*.

7. *Equus* sp. (Text-fig. 2.)

There is one equine tooth in the collection, the upper second premolar of the left side with the crown moderately worn. This has been compared with a number of

corresponding teeth from various recent species, but this single example seems insufficient even to show definitely that it belonged to a horse. In size it agrees with that of *E. hemionus*, the larger of the Asiatic asses. Its principal measurements are: maximum height 66 mm., antero-posterior length of worn surface 35 mm., maximum width of worn surface 27 mm.

8. *Rhinoceros hemitoechus* Falconer. (Text-fig. 3.)

A rhinoceros is represented by a single fragment found in the disturbed layer. This is the central portion of a tooth which is probably an upper fourth premolar of the left side. This is such a characteristic fragment that there can be little doubt that it represents *R. hemitoechus*. Owing to the advanced stage of wear of the tooth

FIG. 3. *RHINOCEROS HEMITOECHUS.* CENTRAL PORTION OF AN UPPPER FOURTH PREMOLAR, WITH OUTLINE RESTORED, NATURAL SIZE.

the internal borders of the anterior and posterior ridges have become confluent, causing the median valley to be completely surrounded by enamel. The maximum length of this valley is 23 mm. There are three projections from the posterior lobe into the median valley. The crochet is bifid, a condition which according to Professor Marcellin Boule (1910, p. 169) obtains in the premolars, whereas in the true molars this crochet is generally simple. This condition was also fully described and figured in Falconer's (1868) original description of the species.

Confirmatory evidence of this identification is provided by the tooth shown in text-fig. 4. This is a left last upper molar of *R. hemitoechus* kindly lent by Mr. R. von Heidenstam of Débayeh, near Beirût, who collected it near the mouth of the Dog River.[1]

Rhinoceros remains have long been known to occur in the Pleistocene Cave-deposits of Syria, and were recorded as long ago as 1878 by Oscar Fraas and later

[1] This specimen has since been very kindly presented to the British Museum (Nat. Hist.), and is registered as M 13101.

by W. Dawson (1894, p. 45). Father Zumoffen (1900), who has made such valuable explorations of many caves and rock shelters in Syria, found remains of *Rhinoceros* to be quite plentiful in deposits at Ras-el-Kelb, near Beirût.

All previous authors have recorded the *Rhinoceros* remains from Syria as those of *R. antiquitatis*, the Woolly Rhinoceros, which is always found associated with *Ovibos*, *Rangifer tarandus*, *Elephas primigenius*, or other members of the so-called cold fauna. In western Europe *R. hemitoechus* is usually found, not with the above, but with a somewhat earlier Pleistocene fauna (*Elephas antiquus*, etc.) than that accompanying *R. antiquitatis*. Apparently *R. hemitoechus* has not been recorded previously from the South-Eastern Mediterranean region.

It is evident from the position in which the specimen from the Emireh Cave was

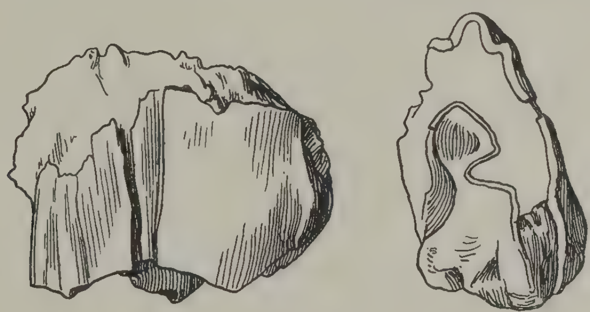


FIG. 4. *RHINOCEROS HEMITOECHUS*. CROWN AND LATERAL VIEWS OF A LAST UPPER MOLAR, TWO-THIRDS NATURAL SIZE.

found that it cannot be earlier than late Middle Palaeolithic, though there is a possibility that this species survived until later times.

In his interesting volume on the Animals of the Bible, Canon Tristram (1898) discussed the question of the identity of the Unicorn, and came to the conclusion that it could not be the rhinoceros. He based his argument chiefly on two points:

(*a*) That the Jews could hardly have been acquainted with the rhinoceros, and
(*b*) That the Bible referred to an animal having two horns.

Perhaps a different conclusion might be reached now that the finding of these remains in the Emireh Cave shows that a rhinoceros existed in Palestine at any rate in Palaeolithic times, and so may have been known to the early Jews, at least by tradition. As for the two horns of the biblical unicorn, this is the number that was carried by *R. hemitoechus*.

SECTION V

EXCAVATION OF THE PALAEOLITHIC CAVE MUGHARET-EL-ZUTTIYEH

BY F. TURVILLE-PETRE

FIRST SEASON'S WORK, 1925

ENTERING the ravine of the Wadi el 'Amud and walking some 150 m. up stream, a cave known as the Mugharet-el-Zuttiyeh is to be seen high up in the cliffs to the north of the stream (Plate VIIIa). The stream at this point is not more than 3 m. wide, and the width of the ravine from base to base of the cliffs might be estimated at about 15 m. The cave, a natural limestone formation, is situated at the base of a precipitous wall of rock, facing south-west; the cliff, which rises to a height of some 20 m. above the entrance, renders it inaccessible from the plateau above; while from below, the cave, the modern floor of which lies some 40 m. above the level of the stream, is approached by a steep, rocky slope. Inside it measures some 19 m. in depth and varies in breadth from 12 m. at the entrance to 18 m. towards the centre; the oval-shaped entrance rises to a height of 10 m. above the modern floor, and is further narrowed by a mass of rock some 2 m. high, projecting from the south-east wall. The roof forms a kind of vault which reaches to a height of over 12 m. above the modern floor and is honeycombed with natural clefts which penetrate far into the rock.

No flint implements, or other evidence of habitation, were to be seen either on the floor of the cave or on the slope which led up to it,[1] but its size and convenience as a place of habitation, together with the impregnability of its situation, seemed to merit the digging of a trial trench through the debris which had accumulated during generations of use as a stabling for goats.

A preliminary trench (Trench A) was dug from the mouth of the cave inwards to the back wall, running some 2.5 m. north-west of the medial line of the cave (Plate IXb). For the first 120 cm. the deposits were of comparatively recent origin, yielding fragments of bone and potsherds, among which Late Roman and Byzantine

[1] Karge mentions having found a flint flake outside the cave (*Rephaïm*, p. 295).

types predominated, but at a depth of 120 cm., towards the front of the cave, a layer was reached composed of large blocks of rock apparently fallen from the roof, and from below these blocks some fragments of bone in a highly mineralized state were obtained; also a small *coup-de-poing* of Middle Palaeolithic type and a few chert flakes of indeterminate form.

Owing to the large blocks of rock which had to be extracted, it was not possible to reach bed rock anywhere in this trench. It was, however, in places, dug to a depth of 2 m., which subsequently proved to be within a few centimetres of the bottom of the palaeolithic habitation level. The evidence obtained, scanty though it was, sufficed to indicate the probability that the cave had been occupied in early times and it was determined to initiate a systematic excavation. A continuation of the trench inwards showed that at a distance of some 12 m. from the back wall the rock floor sloped steeply upwards (see Plate IXa), confining the area of possible early occupation to the front part of the cave. Similarly a continuation of the trench out on to the terrace showed that outside the cave the deposits rapidly diminished in thickness, finally disappearing altogether at a distance of about 11 m. outside the entrance, leaving a rough, rocky descent into the valley below. The area of early occupation was thus approximately defined at a very early stage in the excavations, and since this obviated the necessity of clearing the back part of the cave, the amount of work required was considerably reduced.

A second trench (Trench B) was next dug, running south-east of the medial line of the cave. As shown in the plan, this trench had to be interrupted near the centre of the cave, owing to three large blocks of rock resting on the surface which could not conveniently be removed with the labour available; subsequently these blocks were thrown down into the excavated central area and the deposits beneath them cleared to rock. This trench substantially confirmed the indications given by trench A as to the extent of the palaeolithic habitation area.

The next step was the removal of the superficial deposits covering the palaeolithic layer between trenches A and B. The area to be excavated at this stage was naturally limited outside the cave by the line of disappearance of deposits on the sloping terrace; inside the cave a temporary limit was fixed by a line drawn from the point where the rock began to slope steeply upwards in trench A to the blocks of rock which had interrupted the completion of trench B. These deposits were removed in five layers. The first layer, 0 to 15 cm., consisted of dry dung due to the use of the cave in quite recent times as a stabling for the goats of the recent Bedouin. This layer contained no bone or pottery. In the second layer 15 to 60 cm., and the third 60 to 80 cm., which included the two upper fire levels, a considerable quantity of pottery fragments were found. These were mostly of Byzantine type, though some

fragments of Arab ware and some of earlier type were found with them. In the fourth layer, 80 to 100 cm., which included the third fire level, the pottery was predominantly of types characteristic of the Early Iron Age I (1800 B.C.), though here also many pieces of later type were found, as also a few fragments of Bronze Age ware. The fifth layer to be removed, extending from about 100 cm. down to the layer of fallen rock at 120 cm., contained sporadic traces of fires; the potsherds were very mixed in type, but Bronze Age ware occurred here for the first time in any quantity, together with a few fragments ascribable to a Neolithic or extremely early Bronze Age date.

In spite of the somewhat mixed nature of the pottery from the various levels, it would seem to be possible, with the aid of the fire levels, to establish the successive periods of occupation of the cave with considerable exactness. Thus it would seem that during the late Roman and Byzantine period, corresponding to the two upper fire levels, the cave was continuously occupied for a considerable period; an earlier period of occupation, corresponding to the third fire level, must be ascribed to the Early Iron Age. Still earlier, the cave was frequently, if not continuously, occupied during the Bronze Age, as is shown by the numerous hearths and fragments of early pottery found between the Early Iron Age fire level, and the layer of fallen rock. Only one specimen of Neolithic flint work was found, and in spite of occasional fragments of very early, possibly Neolithic, pottery, the cave can never have been occupied by a people in a truly Neolithic stage of culture. In the Hellenistic and Arab periods, to judge from the comparative rarity of potsherds of these dates, though occasionally visited, the cave was not used as a regular habitation. The character of these superficial deposits was very homogeneous. Throughout they consisted of a damp blackish or dark brown earth, containing a considerable proportion of decomposed organic matter; bone was mostly in a soft, spongy state, extremely liable to crumble.

At a depth of about 120 cm., the layer of fallen rock already noticed in trenches A and B, was found to be continuous all over the central area of the cave. Below this layer of rock there was a marked change in the character of the deposits. They were here composed of a fine reddish, clayey earth, which was comparatively dry; the bone fragments which they contained were hard and heavy, reddish in colour and gave out a sharp metallic sound when tapped. This layer averaged 90 cm. in thickness, and rested on another consisting of yellowish sand, containing water-rolled pebbles. Throughout the layer were blocks of fallen rock, but they never formed a continuous layer, as they had done at a depth of 120 cm. In particular, one enormous block, measuring 4 by 3 m. and having a thickness of about 50 cm., may be mentioned as having effectively isolated the area beneath it from all intrusion

of remains from higher levels. Below this block a number of flint implements and mineralized bone fragments were found, but no potsherds, such as had slipped through in considerable quantities into other parts of the layer.

The floor of the cave was extremely irregular, rising at the centre to a height of 50 cm. above the base of the palaeolithic level. This eminence would seem to have formed the central point of the dwelling, for resting on it and adhering to its sides were masses of breccia of varying degrees of hardness, containing fragments of bone, broken flint implements, and traces of burnt matter, representing, presumably, remains of habitation debris subsequently hardened by mineralization. Similar masses of breccia were found scattered throughout the layer, and these were in some cases so hard as to make it impossible to extract either bone or flint from them in anything but an extremely fragmentary condition. Fortunately only a small part of the deposits had thus become hardened, and throughout the layer numerous fragments of bone and many worked flints in good condition were found.

The implements, as also the bone fragments, are discussed in a separate note. It may here, however, be stated that no implements were found anywhere above the dividing layer of rock, showing conclusively that the deposits had undergone no serious disturbance since their deposition.

Towards the bottom of this layer of palaeolithic occupation, at a depth of 2 m. below the modern floor level, were four fragments of a human skull. Their approximate resting-place is marked X on the plan. They were lying in a shallow depression formed by irregularities in the cave floor, and were covered by two blocks of rock apparently fallen from the roof. The frontal bone has been separated from the skull to which it originally belonged along the line of suture, but there is nothing to indicate that the separation was produced by force, or least of all to suggest that the individual may have been killed by the fall of the rocks beneath which the fragments lay. Nor was there anything in the position of the bones and arrangement of the blocks of rock to suggest an intentional burial. It is difficult to surmise what may have become of the rest of the skull. Careful sieving of all the earth taken from the surrounding area and from numerous other parts of the layer failed to disclose any further human remains. The fact that the four fragments, namely the frontal bone, part of the right zygomatic bone, and two fragments of the sphenoid, were all found together, indicating that they have become separated since reaching their final resting-place, seems to preclude the probability of their having been washed into the cave from outside, for in such a process the projecting sphenoid portions would almost inevitably have become detached; nor is it possible that they could have fallen through from a higher level, for if so, how did they come to lie beneath two large blocks of rock, themselves entirely covered by palaeolithic

deposits. The bone itself is in a hard, highly mineralized state, extremely heavy and reddish in colour, in fact in every way similar to the other bone fragments found in the layer; it differs absolutely from the soft light pieces of a yellowish colour found in the superior layers. A description and an anatomical study of the skull fragments by Sir Arthur Keith follows (page 53).

When the central area had been completely cleared to the bottom of the palaeolithic level as described above, attention was directed to the strip of deposits left between trench A and the north-west wall of the cave. These were removed, and showed a succession entirely similar to that found in the centre. As was to be expected, the original habitation area was reduced by about 1 m. along its whole length, by the rock sloping steeply down toward the centre; as before, the palaeolithic layer yielded flint implements and fragments of bone.

At the same time that work was being carried on in this strip, the excavation of the central area was continued inwards towards the back wall, so as to include the full extent of the palaeolithic habitation. This was found to end, as was anticipated, some two metres inward of the point already reached, and a trench (Trench C), prolonged to the back wall, showed that no further deposits of interest could be hoped for in this direction.

A trench dug through the deposits between trench B and the south-east wall showed that only a very narrow strip of palaeolithic layer remained unexcavated there, and as it was unlikely that any new information could be obtained from its clearance, it seemed preferable to leave the section standing to show the sequence of deposits.

SECOND SEASON'S WORK, 1926

When the work at the cave was resumed in April 1926, the first step was to clear off the remaining masses of stalagmitic breccia adhering to the central rock mentioned above, and to the rock to the south-east of the entrance. This breccia had softened considerably by exposure to the air and the greater part of it was removed without difficulty; it contained implements and bone fragments entirely similar to those found in the previous year.

In the same way a thin layer of breccia on the terrace in front of the entrance, which had been found too hard to excavate previously, was cleared to rock, and yielded a number of implements.

It was then found that throughout the habitation area inside the cave, though the base of the palaeolithic level had substantially been reached, it rested on a bed of extremely soft tufaceous material. Stones from the roof falling on this soft material had formed a number of pockets into which earth had fallen, or had driven down earth and stones, consequently it was not surprising to find occasional flint implements below the real base of the layer of occupation; these, however, were infrequent. On the other hand animal bones were numerous and less fragmentary than they had been within the true habitation layer. They were especially frequent in a series of small holes and recesses along the north-west wall of the cave.

When the tufaceous material had been removed it was found that it rested on a series of water-laid deposits which, except along the north-west side of the cave, were of considerable depth, at one point attaining a thickness of nearly 4 m. The upper layers of these deposits had been much crushed and broken into by the falls from the roof. A section through the cave is shown in Plate XV, and another through all the deposits at the deepest point in Plate XVI.

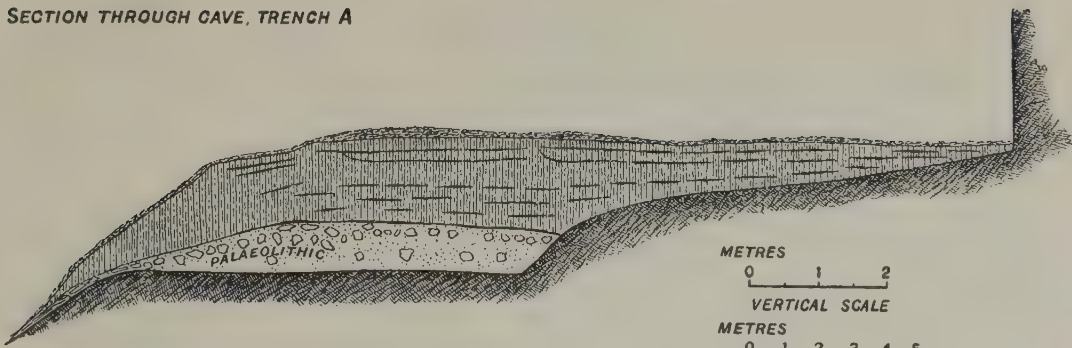
By cutting sections through the water-laid deposits to the bed rock of the cave in various places, it was demonstrated that the central mass of fallen rock referred to above rested immediately on these water laid deposits, with no intermediate layer to indicate a period of either human or animal occupation of the cave prior to the middle Palaeolithic. Masses of rock at the back of the cave were similarly shown to rest directly on laminated sands, so that their removal was obviously unnecessary.

A

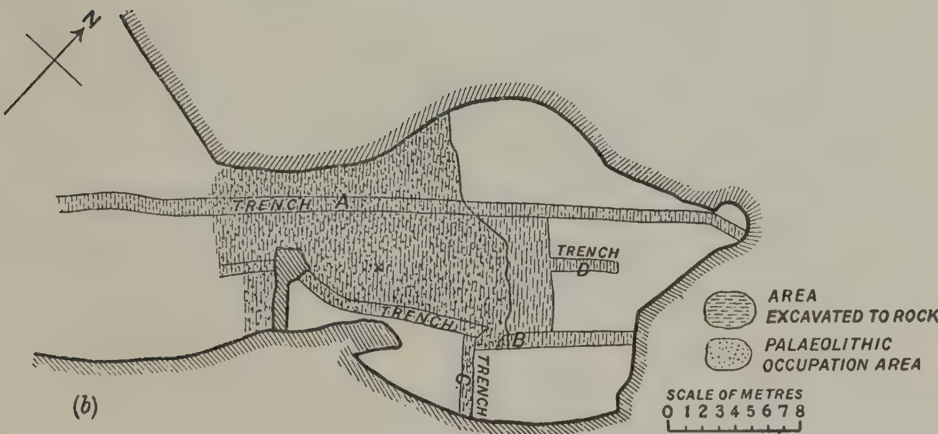
B

MUGHARET-EL-ZUTTIYEH.

(a) General view of cave.
(b) Section through floor deposits.



(a)



(b)

MUGHARET-EL-ZUTTIYEH

(a) Section through floor deposits.

(b) General ground plan of cave.

SECTION VI

CATALOGUE OF THE IMPLEMENTS FROM THE MUGHARET-EL-ZUTTIYEH

COUPS DE POING (Plate X, figs. 1-6). A considerable number of true *coups de poing* were found, of these six, representing the principal variations in type, are shown on the plate. They are all of relatively small size, the largest (fig. 1) measuring 12.7 cm. in length, and the smallest (fig. 3) only 8 cm. In most of the specimens, while one side is carefully worked, the reverse is only roughly shaped out. Fig. 6 is remarkable for the unusual thinness of its pointed end which practically constitutes a blade.

Scrapers (Plate XI). Side scrapers (figs. 1-7) were very abundant and show a characteristically Mousterian technique; the retouching along the scraping edge is bold and regular, in all cases the under surface is smooth and unworked. Fig. 1 is a good example of a curved side scraper, a type not uncommon in Egypt, but rare elsewhere; only one other specimen of this type was found in the cave. Fig. 2 has a particularly clearly defined faceted butt opposite the scraping edge.

Figs. 4, 5, and 7 are retouched along two sides, and fig. 7 suggests a form intermediate between a scraper and a large Mousterian point. Fig. 6 is very finely and regularly worked. Figs. 8, 9, and 10 seem to be roughly worked end scrapers. In fig. 10 the working end, if such it is, curiously overhangs the butt end of the implement.

Points (Plate XII). Various forms of point were found, the triangular point so abundant in Mousterian layers in Europe being especially frequent (figs. 3-7). Figs. 1 and 2 are very thick in section, and from the worked side resemble a small *coup de poing,* though the reverse shows a plain flake surface.

Fig. 5 is a very carefully worked implement in black chert. Fig. 10 is flaked over practically the whole of the upper surface instead of along the edges only.

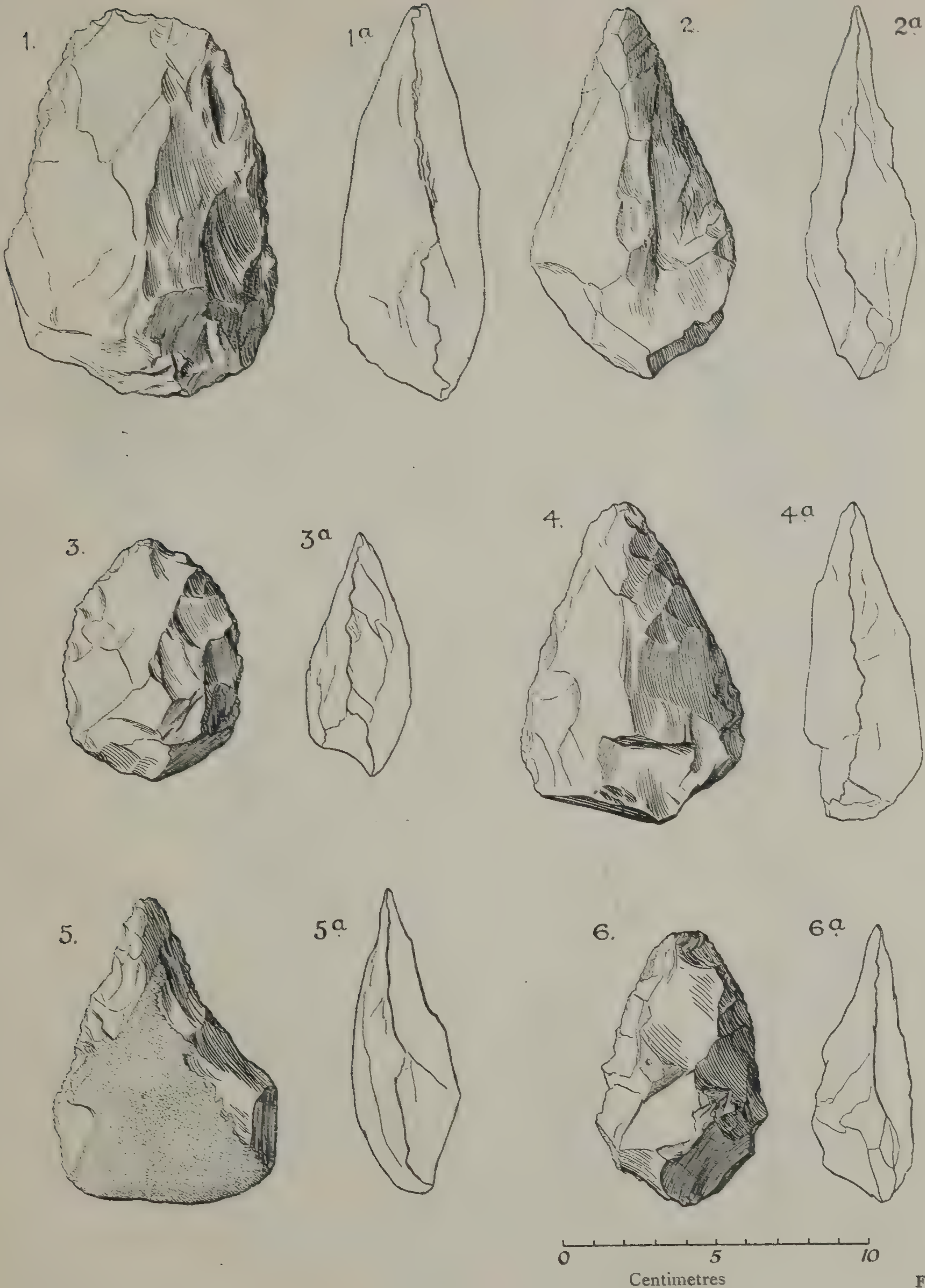
Trimmed flakes and blades (Plate XIII). Fig. 1 is a good example of a Levallois flake prepared on the block and subsequently detached. Figs. 2, 3, 4, and 5 are

retouched along one edge; fig. 6 is flaked over the greater part of the upper surface. Long blades, as figs. 9 and 10, are, in Europe, uncommon in a Mousterian layer, they show signs of use along the edges, but no definite secondary working.

The small blade, fig. 11, is very carefully retouched along one edge. Fig. 12 shows the only example of a notched blade found in the cave, and fig. 13 the only serrated edge.

Discs were fairly numerous, three are shown on Plate XIV, figs. 1-3. Fig. 4 is a prepared core from which a narrow blade like flake has apparently been detached. Fig. 5 is a plunging flake not intentionally produced, but the result presumably of faulty flint. Fig. 6 suggests a rough graver, at least one of its facets seems to have been produced by a graver blow. Fig. 7 is apparently a throwing stone. Fig. 8 appears to be a kind of pick; this type of implement is, in Europe, extremely rare before the mesolithic period. Figs. 9 and 10 show the only borers found.

PLATE X



F

PLATE XI

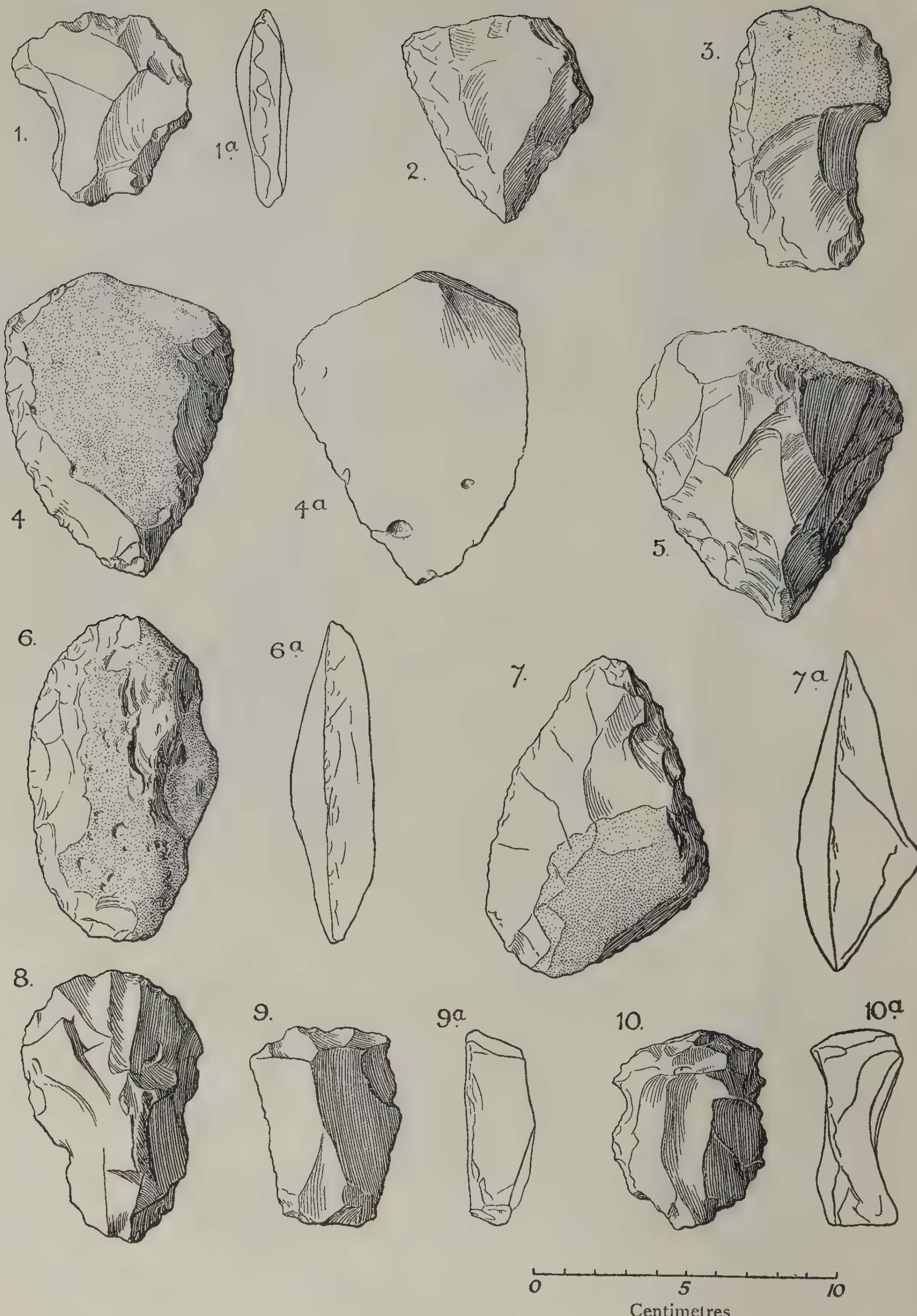


PLATE XII

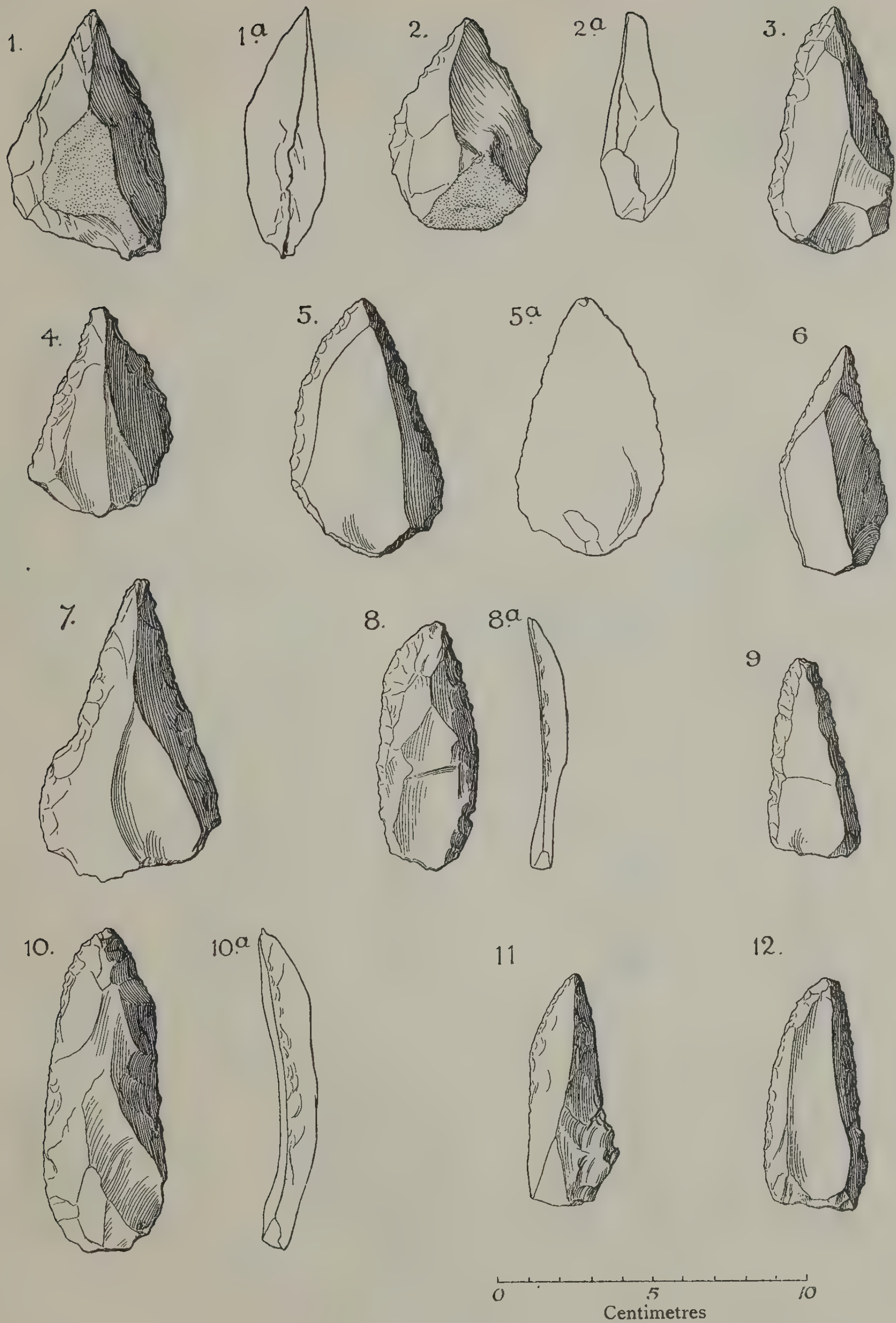
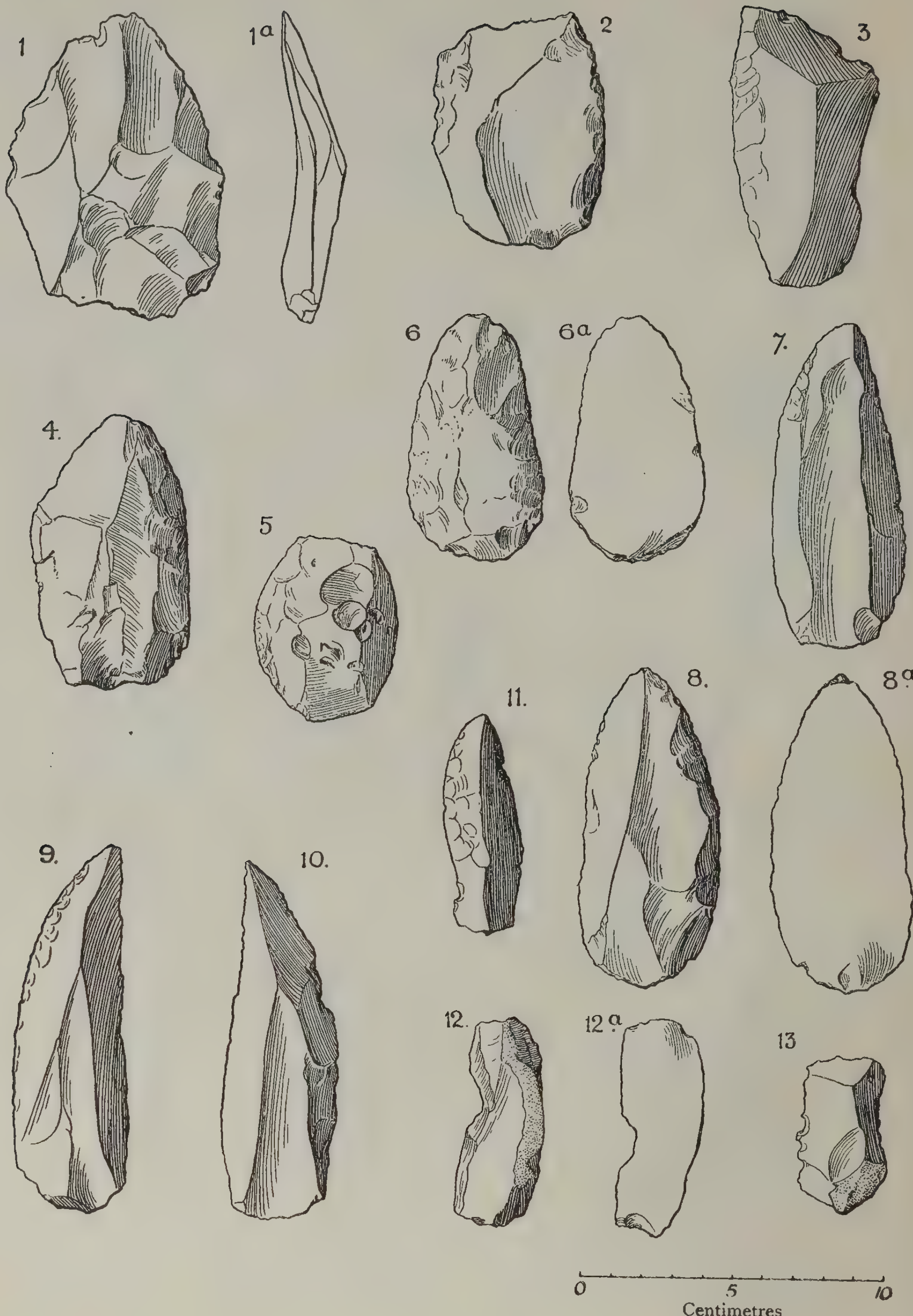


PLATE XIII




1
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Centimetres

SECTION VII

NOTE ON THE GEOLOGY OF THE MUGHARET-EL-ZUTTIYEH

By Charlotte Baynes

SITUATED now at an approximate height of 40 m. above the little stream, on the northern face of the Wadi el 'Amud, the emplacement of the cave very probably indicates an early river level, for on the opposite side of the narrow Wadi the exposed cliff face contains several shallow excavations at about the same height above the present stream as the cave. It stands at the base of a vertical outcrop of rock which rises to about 20 m. above the entrance, and from the terrace outside the cave the hill slopes down so steeply to the river that there is but little accumulation of scree, and the rock is but thinly covered with soil.

The outcrop of cretaceous limestone in which the cave is excavated is very strongly ferruginated, and exteriorly, exhibits prominent bedding planes, defined in many places, principally at the lower levels, by chert, in bands, nodules, and tabular form. These cherty horizons are numerous and of considerable extent.

The structure of the rock in which the cave is excavated is irregular, the stratification being most clearly defined on the left side of the entrance where the beds attain a thickness of 3 m. and dip at an angle of 17 degrees in an easterly direction. On the right side, the beds are considerably thinner, and the angle of the dip is 14 degrees. This change in structure is possibly due, in part, to faulting in the right side of the cliff, where, at one point, above the cave entrance, all trace of bedding disappears and there is some indication of a V-shaped fissure filled with secondary material, as are all the cracks on the face of the limestone. The surface of the rock at this point, however, has been smoothed by weathering, and the form of structure is not obvious.

There is very little jointing to be observed in the rock, either inside or outside the cave. This is probably due to its obliteration by secondary changes.

The cave entrance is of oval shape, 10 m. above the modern floor level at its greatest height, and reaching 13 m. at its greatest breadth. The top appears to

correspond with a bedding plane, but there seems to be no evidence of the influence of joints in relation to the sides.

The terrace of to-day extends for about 11 m. beyond the cave entrance; there is every probability, however, that the mouth has receded to a considerable extent owing to the weathering away of the cliff face. For a great mass of stalagmitic material on the east side of the entrance—both within and without—extends some 3 to 4 m. beyond it. Additional material continues to accumulate in the entrance, owing to continued drip from the rock above; but the outer limit of the drip area must at all times have been under the exterior face of the rock.

Inside the cave, the rock presents much unevenness of surface. In the vaulted roof are large irregularly shaped hollow spaces from whence huge masses of rock have fallen in a remote past. Some of these rocky masses, being smashed by their fall, were found tightly jammed together in the sandy deposit underlying the palaeolithic layer. Others, unbroken, remained where they fell; two very large masses, one in the central part and the other on the south-east side of the cave, sticking up through all the higher deposits. These large rocks were thickly coated with a ferruginated stalagmitic breccia, to the surface of which many flint and bone fragments had adhered. Some of the fragments were very brittle and dark in colour, as if burned, this being due to the action of iron and manganese salts.

The nearly vertical walls of the cave also exhibit much irregularity. The face of the rock is uneven, with many projections, hollows, and cracks, large and small; a stalagmitic coating of varying thickness, together with growths of lichen, producing a streaky appearance on the surface. There is one large embayment in the north-west corner, the shape being irregular in outline and the influence of bedding planes or joints not being obvious.

The cave has been excavated by water, the stream having entered the north-east corner through a swallow hole which has its aperture into the cave at some 2 m. above the modern floor level. From there the channel slopes steeply upwards, and at a height of about 10 m. above the floor becomes a round hole, with an approximate diameter of 1.5 m. It is possible to crawl up some little distance beyond this point, until the passage narrows rapidly, and taking a perpendicular direction, upwards, becomes a mere crevice, leading in all probability to the mountain-top. The mouth of the swallow hole, and the channel, has been reduced in size by stalagmitic accumulation. The angle of descent of the swallow hole being a steep one, the water has cut down deeply into the cave floor and formed a rock pool. The lowest point laid bare by trench excavation is 18.55 m. below the apex of the roof. From this spot the floor slopes rapidly upwards in every direction; on the western side the measurements from the roof to the floor being 13.60 m.

The limestone floor, on which the cave deposits rest, is much ironstained, and contains a fair proportion of magnesium carbonate in its composition. Wherever this was laid bare by trench excavation, layers of stalagmitic and phosphatic deposits were revealed, encrusting and replacing the original limestone. These deposits are secondary ones, being due to the action of percolating phosphatic and ferruginous solutions on the normal limestone.

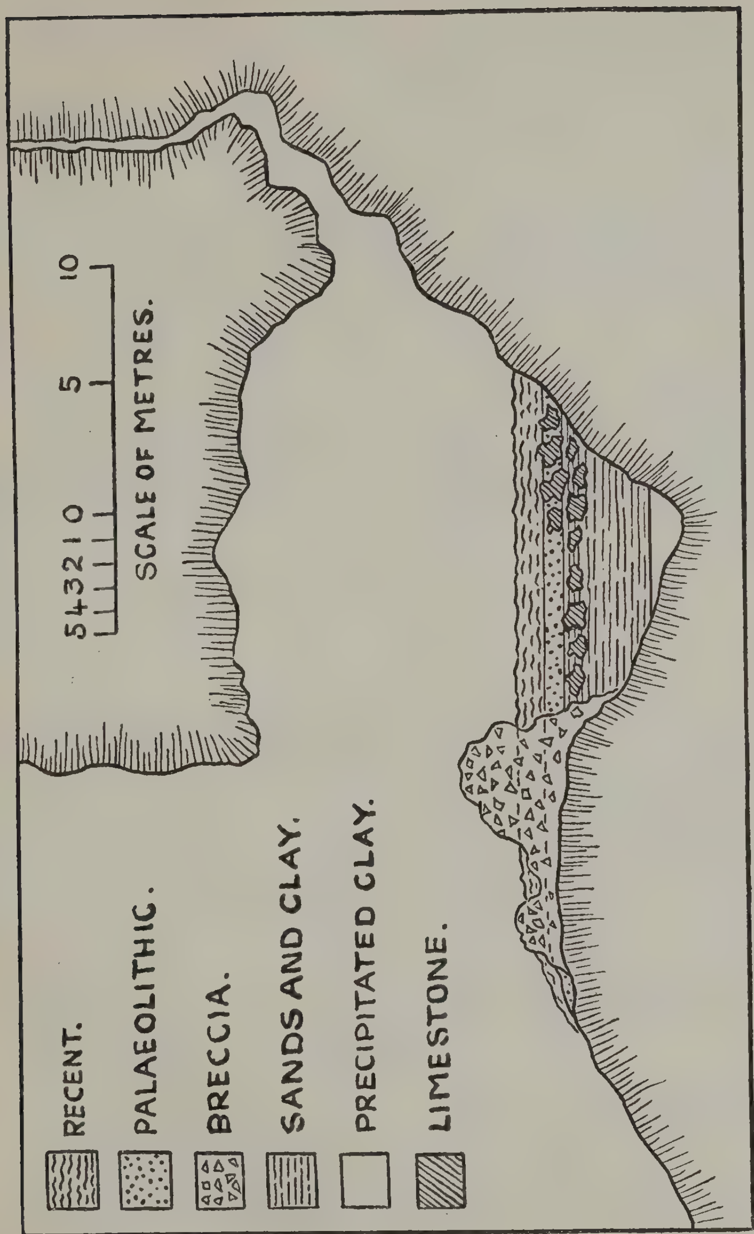
The succession of deposits from the phosphatized limestone floor up to the base of the palaeolithic occupation layer is an interesting one. The lowest—a ferruginous clay, crimson red in colour—appears to be a chemical precipitate of iron and aluminium hydrated oxides; microscopical examination revealing no detrital particles such as would be found in sediments deposited by flowing water, the inference being, that after excavation of the cave to its lowest level by the stream, there must have followed a period during which the inflow ceased and the action of precipitation took place in the still water. This layer of deposit attains a thickness of 50 to 60 cm., after which the colour of the clay changes gradually to an ochreous shade and finally passes into a siliceous, laminated sand, composed of angular quartz grains with an ochreous clay matrix. This normal detrital sediment indicates a renewal of the river flow. It attains a thickness of about 1 m., and the uppermost layers show evidence of shrinkage due to drying, the cracks being filled with carbonates, oxides of iron, and some phosphates. The deposit which succeeds is a yellow-green clay or marl of very fine texture, extremely hard and compact below, but traversed by shrinkage cracks and hollows above, which are filled with phosphatic concretionary masses after the manner of septaria. The tufaceous layers which follow, are practically pure phosphate, and are of very considerable thickness in places—one great mass on the western side reaching over 1 m. in depth. A sandy clay succeeds, again highly phosphatized, as are all the higher deposits up to and including a layer of red sand which immediately underlies the level of palaeolithic occupation. This layer contained much broken rock, fallen from the roof. These fragments of limestone are in a similar condition to the rock floor of the cave and show encrustations and a replacement of the limestone by stalagmitic and phosphatic material.

The greatest depth of the deposits below the level of palaeolithic occupation is rather over 3 m. On the western side, immediately beneath the wall, where the cave floor slopes rapidly upwards and reaches its highest level, the lower deposits are absent and the uppermost layer of red sand rests immediately upon the rock floor. In this place the fallen blocks of rock were tightly packed together, and on removal, many broken animal bones were found beneath and among them.

There are three noteworthy features in the cave deposits: The deep layer of

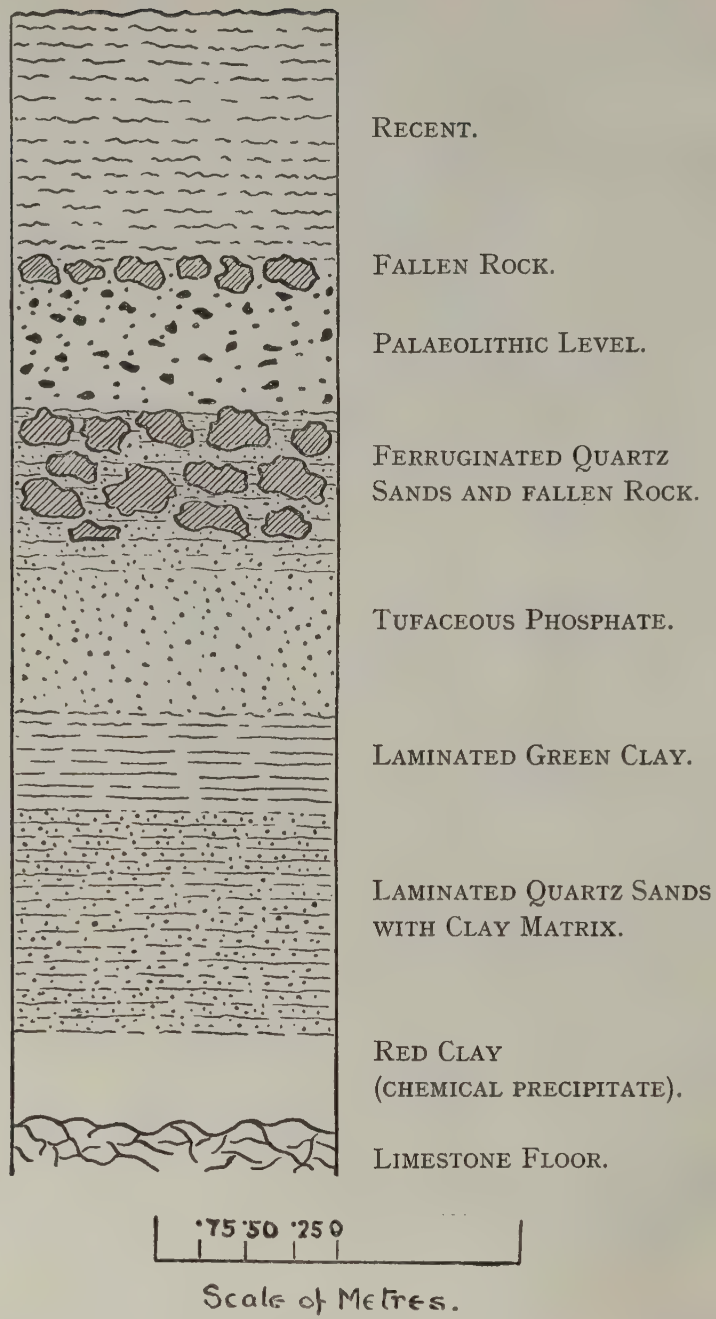
chemically precipitated clay resting immediately upon the cave floor, which seems to indicate the supervening of a dry period of considerable duration immediately following excavation: The very deep deposits of laminated quartz sands occurring in a cretaceous formation. This siliceous material is probably, in part, residual—that is, left on solution of the limestone—and, in part, derived from certain siliceous courses, vestiges of which were noted on the mountain top, above the cave: And thirdly, the general impregnation of all the layers by highly phosphatized percolations. As great masses of pure phosphate occur immediately beneath the uppermost layer of sandy soil in which many animal bones were found, the phosphatic accumulations are probably due to the animal remains at this level. Downward percolating solutions would carry the soluble phosphate through all the deposits to the floor of the cave, where the surface of the normal limestone was found to be overlaid and replaced by stalagmitic phosphates.

A section through the cave is shown in Plate XV, and another through all the deposits, at the deepest point, in Plate XVI.



MUGHARET-EL-ZUTTIYEH. SECTION THROUGH CAVE.

PLATE XVI



MUGHARET-EL-ZUTTIYEH. SECTION THROUGH DEPOSITS AT DEEPEST POINT.

SECTION VIII

ON THE ANIMAL REMAINS OBTAINED FROM THE MUGHARET-EL-ZUTTIYEH IN 1925

By Dorothea M. A. Bate

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THE animal remains dealt with in the following notes were obtained from the Zuttiyeh cave during excavations carried out in the summer of 1925. As described elsewhere in this volume these were found associated with portions of a human skull of Neanderthal type and a number of Middle Palaeolithic flint implements. It is this definite association of flints of this type with human and other animal remains that gives a special interest and value to the collection.

The specimens are not very numerous and are nearly all highly mineralized. In spite of the soft matrix in which most of them were embedded there is hardly a complete bone of any size; practically one-third consists of pieces of bone which have been fractured both longitudinally and transversely before excavation, and they vary from 2 or 3 cm. to 15 cm. in length, rarely exceeding this last measurement.

Considering the comparatively small quantity of identifiable specimens the number of species represented is high, and the list includes over twenty species of mammals, nine species of birds, a chelonian, and a frog or toad. In many cases a species is only represented by one or two bones or teeth and, owing to the fragmentary nature of the material, it has only been possible to give specific determinations in a few instances. This difficulty has also been greatly enhanced by a certain lack of needful recent skeletal material for purposes of comparison.

The impossibility of obtaining definite specific determinations hampers any attempt to gain a comprehensive view of this Middle Palaeolithic fauna as a whole, or as compared either with that of the Late Palaeolithic, or with the present day fauna of the country.

No doubt the excavations which are about to recommence will enable our knowledge in all these directions to be greatly advanced.

The following is a list of the species, followed by brief notes on some of the specimens:

MAMMALIA

1. *Crocidura russula.*
2. *Hyaena* cf. *striata.*
3. *Vulpes* cf. *nilotica.*
4. ? *Herpestes* ? *ichneumon.*
5. *Viverrine* ?
6. *Vormela peregusna.*
7. *Felis chaus.*
8. *Rattus rattus.*
9. *Meriones* cf. *tristrami.*
10. *Microtus* cf. *guentheri.*
11. *Mesocricetus auratus.*
12. *Spalax* cf. *fritschi.*
13. *Hystrix* sp.
14. *Sus* sp.
15. *Hippopotamus* sp.
16. *Cervus* sp. (*C. elaphus* group)
17. *Dama mesopotamica.*
18. *Gazella arabica.*
19. *Gazella* sp.
20. *Capra* sp.
21. *Bison* or *Bos.*
22. *Equus* sp.

AVES

1. *Turdus* sp.
2. *Sturnus vulgaris.*
3. ? *Pycnonotus* sp.
4. *Cypselus melba.*
5. *C.* ? *affinis, Gray.*
6. *Aquila* sp.
7. *Columba livia.*
8. *Coturnix communis.*
9. *Phasianus hermonis*, sp. nov.

REPTILIA AND AMPHIBIA

? *Emys orbicularis.*

? *Bufo* or *Rana.*

1. *Crocidura russula* Hermann.

An imperfect right mandibular ramus of a shrew containing the two anterior molars[1] resembles that of recent examples from Palestine.

2. *Hyaena* ? *striata* Zimmermann.

A very imperfect humerus of a hyaena seems to agree with that of *H. striata*, the species still living in the country.

3. *Vulpes* ? *nilotica* Rüpp.

A small fox is represented by an imperfect right mandibular ramus without teeth. Tristram (1884, p. 22) described two foxes from Palestine, one a small form

[1] This specimen was obtained by the writer during a brief visit to the cave in September 1925.

living in the southern and eastern parts of the country and a larger race, *V. ? flavescens*, in the northern area. It is interesting to note that Mr. Oldfield Thomas (1920) in describing a small fox from Palestine, *V. v. palaestina*, mentions that this sub-species is also found in the Lebanon.

4. ? *Herpestes* ? *ichneumon* Linn.

A complete humerus in the collection may belong to this species, or to a closely allied genus. No recent material was available for comparison with this specimen.

5. *Viverrine* ?

The proximal portion of a femur and the distal half of a tibia, belonging to a larger animal than the last, are also believed to represent a member of the Viverrine group of carnivores. Again insufficient recent material was available for comparison.

6. *Vormela peregusna* Gueldenstaedt.

Nehring (1902) described a stone marten, *Mustela palaesyriaca* from the cave of Antelias near Beirût. The only specimen of a Musteline in the present collection is the posterior half of a skull which agrees with that of recent specimens of *Vormela peregusna*. This animal is not uncommon and is widely distributed over the country, there being, for instance, skins in the British Museum Collection from Galilee, Gaza, and the Jordan Valley.

7. *Felis chaus* Gueld.

The proximal end of a radius agrees with that of a recent specimen of this jungle cat.

8. *Rattus rattus* Linn sp.

A rat is represented by a left mandibular ramus containing its full complement of teeth. At the present day a form of this rat, *R. r. alexandrinus*, is abundant throughout the Mediterranean region.

9. *Meriones* cf. *tristrami* Thos.

Remains of a gerbil include a fragment of a skull, three mandibular rami, and two isolated incisors; all the teeth are represented except the last upper molar.

These fragments agree with the corresponding parts in recent specimens of *M. tristrami* from various localities in Palestine in the British Museum Collection. It seems permissible, therefore, to consider them provisionally as belonging to this species. No more can be said from this small amount of material since the skull

characters are the chief means of distinguishing many of the species of this genus (O. Thomas, 1919).

10. *Microtus* cf. *guentheri* Danf. and Alston sp.

Remains of voles are not numerous but include an imperfect skull retaining all the teeth except the two anterior molars of the right side, and six mandibular rami, only one of which retains any of the cheek teeth. All these specimens agree with recent examples from Palestine collected by Canon Tristram and now in the British Museum. A number of voles obtained by the Phillips Palestine Expedition (Allen, 1915) in a valley west of Mount Hermon have also been provisionally referred to this species.

11. *Mesocricetus* cf. *auratus* Waterh.

A single left mandibular ramus, with the anterior molar in position, agrees with the corresponding part of the type specimen of *M. auratus* from Aleppo in the British Museum Collection.

12. *Spalax* cf. *fritschi* Nehring.

A mole rat is represented by portions of several mandibular rami, only one of which retains any teeth—an incisor and an anterior molar. These fragments may represent *S. fritschi*, an extinct species described by Nehring (1902, p. 77) from the Antelias Cave near Beirût. Though seldom seen, a mole rat is one of the commonest mammals of Palestine, the mounds of earth raised through its activities being noticeable nearly everywhere.

13. *Hystrix* sp.

A porcupine is only represented by two fragments of incisors and an unworn upper right premolar. Two species are said to occur in Palestine at the present day.

14. *Sus* sp.

A pig is represented by a complete incisor and a fragment of another. A wild boar is still commonly found in many parts of the country.

15. *Hippopotamus* sp.

Only one specimen can be definitely assigned to *Hippopotamus*; this is the proximal portion of a left femur which includes the head and lesser trochanter. In size this specimen can be matched with the corresponding bone in recent examples of *H. amphibius*. The fossil is extremely robust, the bone tissue of the shaft attaining a thickness of 22 mm., measuring from its outer surface to the inner cavity containing

bony cancellous tissue. Two fragments of shafts of bones in which a corresponding measurement shows a thickness of 17 mm. may also belong to the same species.

Fossil remains of hippopotamus have already been obtained from the Pleistocene deposits of Râs el Kelb, near Beirût. Two portions of teeth have been figured by Father Zumoffen (1900, Plate XIV) and an imperfect last lower molar collected by Professor A. E. Day is in the British Museum (B.M., M 12811). None of these specimens is sufficiently complete to admit of specific determination, but the last mentioned agrees in size with some examples of the corresponding tooth of *H. amphibius*.[1]

In the collection from the Zuttiyeh Cave the hippopotamus is the species most unlike any of the present day fauna of the country. However, this occurrence in comparatively recent times need not seem extraordinary, for Canon Tristram (1898, p. 50) was of the opinion that the Behemoth mentioned in the fortieth chapter of the Book of Job referred to the hippopotamus, which evidently then lived in the Jordan Valley, if not in other parts of the country. In this connection it may be interesting to note that two specimens were killed near Damietta as lately as the year 1600 (Newberry, 1924, p. 177), since which time the northern limit of this animal's range has been pushed back to south of the First Cataract.

Another instance of an animal surviving in Palestine is that of the crocodile, which inhabited the Zerka river near Mount Carmel. A specimen was captured by Bedouin and brought in to Haifa as lately as 1902.[2]

16. *Cervus* sp.

A deer belonging to the *Cervus elaphus* group is represented by three imperfect teeth; portions of a femur, metatarsus, and axis vertebra may also belong to the same species. The teeth agree in size with some corresponding specimens of *C. elaphus*, but the limb bones are considerably smaller than those of *C. e. maral*, the eastern form of the Red Deer, with which I have compared them.

Red Deer no longer occur in Palestine, but remains have been obtained somewhat sparingly from cave-deposits in the Lebanon (Fritsch, 1893, p. 14).

17. *Dama mesopotamica* Brooke.

Two worn lower molars and an upper molar seem to belong to this species. An

[1] Since writing the above I have had the opportunity of seeing two upper molars, undoubtedly those of *H. amphibius*, which were obtained some years ago by Mr. Ford during excavations for the foundations of a house at Sidon.—D.M.A.B.

[2] *Mittheil. Nachricht Deutsches Palaestina-Vereins*, 1903 (1902), 64. Since the above was written Mr. G. J. H. Ovenden has drawn my attention to a very interesting paper on this subject by Dr. E. W. G. Masterman, "Crocodiles in Palestine," Palestine Exploration Fund, Quarterly Statement, Jan. 1921, p. 19.

imperfect metatarsus can only be very tentatively associated with these teeth as unfortunately there is no recent skeletal material available for comparison. This interesting large Fallow Deer is very rare at the present day and its habitat is restricted to remote parts of Persia. Formerly its range was more extended and its remains have been found in great quantities in several cave deposits in Syria.

18. *Gazella* cf. *arabica* Lichtenst. sp.

Remains of gazelles are fairly numerous and seem to suggest the presence of at least two species. One of these is represented by two mandibular rami, containing the nearly complete series of cheek teeth. These agree with those of a recent specimen of *G. arabica* from Arabia (B.M., 69, 10, 24, 100). Some nearly complete horn cores, the longest measuring 15.5 cm. along the outside curve, probably also belong to this species. A form of this gazelle is still found in Palestine and Syria, although not in any great number.

19. *Gazella* sp.

About twenty metapodials and portions of other limb-bones are ascribed to a gazelle, but seem to be too large and robust to belong to *G. arabica*. Little recent skeletal material is available for comparison, but the specimens in question agree closely, except in slightly greater size, with the corresponding bones of an example of *G. subgutturosa sairensis* in the British Museum (B.M., 90, 4, 20, 11). This species stands about 27 inches at the shoulder, that is about the size of a typical roe deer, whereas in *G. arabica* the shoulder height is 24 or 25 inches.

20. *Capra* sp.

A goat is represented by a few teeth and the distal end of a metacarpus. Some of the molars agree with those of *C. nubiana*, which was not uncommon in Palestine until the early part of this century.

21. ? *Bison* or *Bos*.

A bovine is represented by a last lower molar of the right side with the root fangs broken off. The crown surface is only slightly worn and the greatest height of the crown is 50 mm. Owing to the loss of the anterior half of the front lobe the antero-posterior length of the tooth cannot be accurately taken, but this must have been at least 50 mm. There are also a worn first lower molar and a lower premolar probably belonging to the same species.

From such scanty material it is not possible to determine whether these teeth belong to *Bison* or *Bos*, remains of either of which might be expected to occur in this deposit.

22. *Equus* sp.

Only one bone can be referred to a horse or an ass. This is the distal articular end of a metapodial of a young individual measuring 35 mm. in extreme width. This specimen is not so highly mineralized as most of the remains.

AVES

Among a number of fragmentary bird remains nine species have been determined and a list of these has been given above. With one exception these probably

FIG. 5. *PHASIANUS HERMONIS*, SP. NOV. PROXIMAL PORTION OF LEFT TARSO-METATARSUS, ANTERIOR AND LATERAL VIEWS, NATURAL SIZE.

belong to species still found living in the country. This exception is a gallinaceous bird represented by a single fragment, the proximal portion of a left tarso-metatarsus. Comparison of this characteristic specimen with the corresponding bone in a number of genera shows that it agrees most closely with that of *Phasianus*, while also showing considerable resemblance to that of *Pavo*.[1] As it has not been possible to identify it with any known species, it is proposed to distinguish the bird from the Zuttiyeh Cave as

Phasianus hermonis, sp. nov. (Text-fig. 5.)

The type specimen is shown in the accompanying figure.

Characters: Tarso-metatarsus absolutely larger than in any recent pheasant. The centre of the single tubercle for the insertion of the distal end of the tibialis anticus is 1.1 mm. to the right of the median line of the anterior face of the bone.

[1] Since going to press, the distal extremity of a left tibio-tarsus of this species has been found among the avian remains obtained from Zuttiyeh in 1926. This specimen corroborates what has been said above.

Measurements of type specimen:

The proximal articular surface has a transverse diameter of 17.5 mm., and an antero-posterior diameter of 16 mm. The antero-posterior diameter of the hypotarsus is 9 mm., and the least transverse diameter of the shaft 8.5 mm.

The tarso-metatarsus to which the specimen from the Zuttiyeh Cave shows most resemblance is that of the Miocene species *Phasianus altus* Milne-Edwards, a specimen of which is in the British Museum Collection (A. 313) and was described and figured by Lydekker (1893). These two bones are almost identical in size, in the shape and size of the tibial cups and their dividing tubercle, and also in the construction of the hypotarsus with its single tube and shallow grooves.

The Zuttiyeh specimen differs from the Miocene one in the position of the single prominent tubercle for the distal insertion of the tibialis anticus, which is placed more in the centre of the anterior face of the bone, which is deeply excavated.

It may be mentioned here that in the case of *P. altus* other portions of the skeleton have also been obtained and confirm the generic determination.

The tarso-metatarsus of *P. hermonis* is a relatively much longer bone than that of *Tetrao* or *Tetraogallus*, and is also not so flattened antero-posteriorly as in these two genera, or as in *Gallus*.

This discovery of the remains of a large pheasant is interesting, for records of an earlier avi-fauna are curiously rare. Pheasant remains have been obtained from the Miocene of France, Switzerland, and Germany; from the Lower Pliocene of Pikermi; and from a cave-deposit in Germany.

At the present day Asia Minor and the Caucasus are the homes of *Tetraogallus* and *Phasianus colchicus* respectively, so it is not surprising to find that pheasants formerly inhabited the Galilean hills which form a part of the long strip of mountainous country reaching from Asia Minor practically to Sinai, and including the heights of Lebanon and Mount Hermon. In this connection it is interesting to remember that the former forests of Lebanon were not always exclusively coniferous, for remains of oak, beech, elm, and hazel have been recorded (Karge, 1917, p. 29) from a moraine deposit near Bšerre in the Lebanon range between Beirût and Tripoli.

Chelonia

? *Emys orbicularis* Linn sp.

A few fragments of the carapace and plastron probably represent this species, which is still living in Palestine.

Amphibia

Only a few indeterminable limb-bones of a frog or toad are included in the collection.

SECTION VIII (*continued*)

ON THE ANIMAL REMAINS OBTAINED FROM THE MUGHARET-EL-ZUTTIYEH IN 1926

By Dorothea M. A. Bate

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SINCE the previous notes were written further mammalian remains have been collected from the Zuttiyeh Cave during excavations carried out this year (1926). This material is described in the present report and consists, like that of 1925, of few specimens, but includes a comparatively large number of species.

I understand from Mr. Turville-Petre that digging was continued downwards over the area from which the Middle Palaeolithic occupation layers had been removed the previous summer. It will be remembered that highly mineralized animal remains of reddish colour were found in considerable quantities in those layers; similar remains were also found this season, sparingly at first, then gradually decreasing in number as a greater depth was reached, and finally disappearing. Below this were phosphatic deposits enclosing a few bones.

At a still lower level, and in crevices and " pockets " of the irregular rock-floor and side-wall of the cave, a quantity of bones were obtained which are in a different state of preservation from those found at higher levels. They are generally of a light buffish colour, only slightly mineralized and consequently dry and brittle. There is a varying amount of calcareous earth adhering to them, and on some bones this forms a very hard irregular layer almost impossible to remove. These specimens will be referred to in the present note as coming from the lowest layer, *i.e.*, the lowest layer of the cave floor from which animal remains were obtained.

The material last mentioned forms the chief interest of the present collection, for it seems to represent a faunal group possibly earlier than, and different from, that found in the Middle Palaeolithic occupation layers. While these faunal assemblages differ in detail from each other, both agree in including a mixture of what are at the

present day European, Asiatic, and African forms. This mixture is also characteristic of the present-day fauna of Palestine.

Some of the bones and antlers in this lowest layer are fractured and marked in such a manner that it has been suggested that this could only have been done by human agency, although no artefacts or longitudinally split bones were found associated with them. These marked bones will be figured and described briefly later.

A list is given below of the species which have been identified; those marked with an asterisk are additions to the Zuttiyeh Cave fauna and, with the exception of *Apodemus*, *Procavia*, and possibly *Gazella* ? *subgutturosa*, are all from the lowest layer only. A few bird bones were obtained but have not yet been identified. The remains of Amphibia and Reptilia hardly call for any remark; the snake is represented by seven vertebrae which Mr. W. E. Swinton and Mr. H. W. Parker of the British Museum have kindly examined and consider to be those of a species of *Zamenis*, several forms of which still occur in Palestine.

MAMMALIA

*1. *Erinaceus* sp.
*2. *Canis* cf. *aureus*.
*3. *Ursus* cf. *arctos*.
*4. *Hyaena crocuta*.
*5. *Felis* cf. *pardus*.
*6. *Felis* cf. *sylvestris*.
*7. *Apodemus* sp.
8. *Meriones* cf. *tristrami*.
9. *Microtus* cf. *guentheri*.
10. *Mesocricetus auratus*.
11. *Spalax* cf. *fritschi*.
12. *Hystrix* sp.
*13. *Sus* sp.
14. *Cervus* cf. *elaphus*.
15. *Dama mesopotamica*.
16. *Gazella arabica*.
*17. *Gazella* cf. *subgutturosa*.
*18. *Capra primigenia*.
19. *Bison* or *Bos*.
*20. *Procavia cf syriaca*.

REPTILIA AND AMPHIBIA

?*Emys* sp.
?*Zamenis* sp.
Bufo or *Rana*.

1. *Erinaceus* sp.

The distal half of a right humerus of a hedgehog comes from the lowest layer, but is insufficient for specific determination. Two species are found in Palestine at the present day, one closely allied to *E. europaeus*, the other a form of the long-eared hedgehog, *E. auritus*.

2. *Canis* cf. *aureus* Linn.

A jackal of robust proportions is represented by the left and right upper jaws and a right mandibular ramus. From their corresponding size, condition of the teeth, and similar state of preservation, these three specimens probably belonged to a single individual. Nearly all the teeth are represented; in the right upper series the maximum antero-posterior length of the carnassial is 18 mm., while the antero-posterior length of the external border of the two molars is 20 mm. The maximum antero-posterior length of the lower carnassial is 19 mm.

The upper dentition agrees in size and proportions with that of a recent specimen from Asia Minor (B.M., 6.5.1.32), except that in the fossil the anterior premolars are slightly more robust.

Jackals are still commonly found in Galilee and elsewhere in Palestine.

3. *Ursus* cf. *arctos* Linn. (Text-fig. 6.)

No bear remains were obtained from the Middle Palaeolithic occupation layers,

FIG. 6. *URSUS* CF. *ARCTOS*. LEFT MANDIBULAR RAMUS, TWO-THIRDS NATURAL SIZE. OUTLINE RESTORATION FROM SECOND SPECIMEN.

but the present collection includes specimens from the lowest layer which represent three or four individuals. The most important are a right maxilla, two imperfect mandibular rami, a few isolated teeth, a nearly complete pelvis, and a number of incomplete limb bones.

The maxilla retains the two molars, the first being broken and worn, the fourth premolar, and the alveolus of the third. The last molar measures 39.5 mm. antero-posteriorly and has a maximum width of 21 mm. Corresponding measurements in an isolated, scarcely worn, last upper molar are 44 mm. and 23 mm. This tooth in a

recent example of *U. arctos* from Transylvania measures 33 mm. by 17 mm. and in *U. syriacus* 32 mm. by 18 mm.

The left mandibular ramus from Zuttiyeh shown in fig. 6 contains the canine, fourth premolar, and first and third molars. The premolar is simple as in *U. arctos*; this tooth is nearly always more tuberculated in *U. spelaeus*.

Only the canine and second molar are in position in the right mandibular ramus. The extreme alveolar length of the cheek-tooth row, including the fourth premolar to the third molar, is 93 mm.; and the diastema between the alveolus of pm. 4 and the canine is 38 mm.

A number of fragments which were undoubtedly associated have been built up into an almost complete pelvis, which is that of a much larger individual than those to which other pelvic bones in the collection belonged. Its maximum length is 39.2 cm., while in a restored pelvis of *U. spelaeus* (B.M., M 232) this measurement is about 42 cm., and in a recent skeleton of *U. arctos* 29.5 cm.

Among the limb-bones preserved are the fragmentary distal end of a right humerus, with a maximum transverse diameter of 10.2 cm., and the distal half of a left femur, the transverse diameter of the condyles being 90 mm. The above remains are smaller than corresponding specimens of *U. spelaeus* in the British Museum Collection, but, as frequently happens in cave remains, all greatly exceed the size of recent examples of *U. arctos*.

In the absence of the skull, the comparatively moderate size of the jaws and teeth, the shape of the last upper molar, which is contracted posteriorly, the simple character of the last lower premolar, and the presence of the alveolus of the lower pm. 1, seem sufficient evidence for referring these remains provisionally to *Ursus arctos*.

Remains of *U. syriacus* have frequently been obtained from the cave deposits of Syria, but there seem to be only two published records of the larger *U. arctos*: by Weber in 1875 and by Fraas in 1878 (p. 371). Its rarity may be indicated by the fact that Father Zumoffen did not meet with it during his extensive excavations. In 1922 Professor A. E. Day secured remains of both forms from the Late Palaeolithic (? Aurignacian) rock-shelter of Ksar Akil. *U. syriacus* was represented by an imperfect right mandibular ramus, and *U. arctos* by two canines, one in a fragment of the premaxilla, which were found at a depth of eleven metres.

4. *Hyaena crocuta* Erxleben sp. (Text-figs. 7-8.)

This hyaena is represented by several specimens, including a fragment of a right maxilla, containing the unworn second and third premolars; a broken upper carnassial; and two imperfect mandibular rami. The right ramus, shown in figs. 7(A-C),

is broken off posteriorly but contains the canine and all the cheek-teeth. The antero-posterior length of the cheek-tooth row is 82 mm., and that of the carnassial 28 mm. Fig. 8 shows the hinder portion of the left mandibular ramus containing the carnassial, which is similar to the corresponding tooth in the other specimen and like it has a fair-sized but simple talon. The width of the condyle in

FIG. 7. *HYAENA CROCUTA.* THREE VIEWS OF RIGHT MANDIBULAR RAMUS, TWO-THIRDS NATURAL SIZE.

this ramus is 46 mm., and there is a distance of 90 mm. from the lower border of the angle to the top of the coronoid process.

The proportions of the lower carnassial and the absence of the postero-internal tubercle characteristic of this tooth in *H. striata* show that these specimens must be referred to *H. crocuta*. The rami from Zuttiyeh are smaller than those of *H. spelaea* in the British Museum Collection and resemble those of the recent *H. crocuta* with which they have been compared. It should be recorded here that remains of *H.*

crocuta, similar in size to those of the recent animal, have also been obtained from the caves of Gargas, in the Hautes Pyrénées (Gaudry and Boule, 1892, p. 117), although *H. spelaea* is the form commonly found in the cave deposits of Western Europe.

It is interesting that the hyaena remains, which are all from the lowest layer, should prove to be those of *H. crocuta*, the spotted hyaena, which is now restricted to Africa south of Lower Egypt and of the Sahara. This is the first evidence of the occurrence of a hyaena in the Pleistocene of Syria or Palestine, with the possible

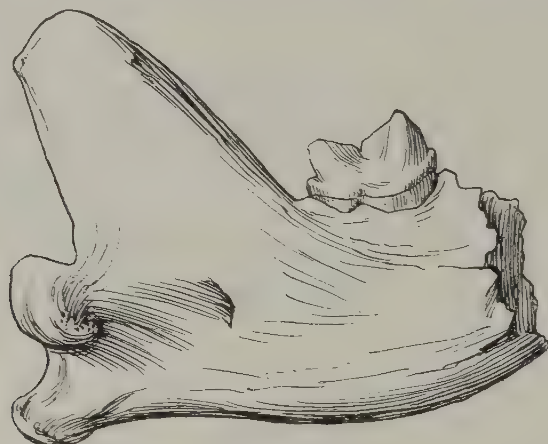

FIG. 8. *HYAENA CROCUTA.* HINDER PORTION OF LEFT MANDIBULAR RAMUS, TWO-THIRDS NATURAL SIZE.

exception of a fragment from the Middle Palaeolithic occupation layers of the Zuttiyeh Cave. This was doubtfully referred to *H. striata* (p. 28), the species now living in these countries, eastwards to India, and in Lower Egypt.

5. *Felis* cf. *pardus* Linn.

The left upper carnassial and a third premolar of a leopard resemble the corresponding teeth in a recent specimen. The distal portion of a tibia may also belong to this species. A less perfectly preserved upper carnassial was obtained by Professor A. E. Day at a depth of eleven or twelve metres from the Late Palaeolithic Rock Shelter of Ksar Akil, near Beirût.

Leopards are still found in Palestine, although they are not plentiful as in earlier days.

6. *Felis* cf. *sylvestris* Schreber.

A wild cat, probably a form of *F. sylvestris*, is represented by an imperfect

right mandibular ramus containing all the teeth, though the canine is broken and the anterior half of the carnassial is wanting. The length of the row of cheek-teeth is 23 mm.

No recent specimen from Palestine was available for comparison. Canon Tristram states that the " Egyptian wild cat " is scarce in the West, but common on the East side of the Jordan.

7. *Apodemus* sp.

Two left mandibular rami of a field-mouse, one of which retains all the teeth, probably come from above the lowest layer. This small amount of material is insufficient for specific determination, particularly as several forms are found in Syria and Palestine.

8. *Meriones* cf. *tristrami* Thomas.

The 1926 collection includes five mandibular rami with teeth, resembling those of this species. From their appearance it is probable that they came from the Middle Palaeolithic occupation layers which have already provided remains of this gerbil.

9. *Microtus* cf. *guentheri* Danf. and Alston sp.

There are a dozen mandibular rami of this vole which appear to have come from the higher layers. Most of the specimens retain the anterior molar and resemble those obtained during the previous excavations.

10. *Mesocricetus* cf. *auratus* Waterhouse sp.

There is a single right mandibular ramus of a hamster which has retained the full complement of teeth. It is probably that of *Mesocricetus auratus*, one of several species found in Palestine and occurring commonly in Syria. This specimen seems to have come from the Middle Palaeolithic occupation layers.

11. *Spalax* cf. *fritschi* Nehring.

The present collection includes two mandibular rami with the anterior molar and a left maxilla with the two anterior cheek teeth of a mole-rat. These, like the other rodent remains, probably come from the Middle Palaeolithic occupation layers.

12. *Hystrix* sp.

A portion of a left mandibular ramuscontaining the three anterior cheek teeth, and several isolated cheek teeth and incisors prove insufficient material for more

particular determination of this porcupine. These specimens are probably from the occupation layers from which similar remains have already been obtained.

13. *Sus* sp. (Pl. XVII, figs. 1 and 2.)

The collection includes remains of a pig of considerable interest. Unfortunately these are few and fragmentary and consist of only three imperfect maxillae and the anterior portion of a left premaxilla containing the first incisor. The premaxilla and two of the maxillae are from the lowest layer, and the two latter are thought to have belonged to a single individual. The left maxilla, which contains the four premolars and first two molars, is shown in Pl. XVII, figs. 1 and 2. The comparatively small size of the alveolus of the canine suggests that the animal was a female. The antero-posterior length of the cheek-teeth row, without the last molar, is 92 mm., and there is a space 4 mm. in length between the alveolus of the canine and first premolar and between that of the latter and the second premolar. The tooth row increases gradually in size from before backwards, and is distinguished by premolars of more simple character than those of the typical *Sus* or of recent specimens from Asia Minor. The second premolar, like the first, is a two-rooted tooth and its crown has a slight internal fold anteriorly and two internal tubercles posteriorly. The third premolar has a wide anterior root and a similar posterior one, while a slender root is seen below the internal border of the centre of the crown; the internal aspect of the crown shows a small pit anteriorly, and a posterior tubercle. The slightly worn crown of the fourth premolar is obtusely triangular, and has only three roots, a large postero-internal one and two external ones.

The general aspect of the above tooth row is very similar to that of *Potamochoerus*, except that in the latter the difference in size between the second and third premolars is very much greater.

This small amount of material is insufficient to show conclusively a close connection with the African River-hogs, but it does, at least, prove the presence in this lowest layer of a pig differing from, and probably more primitive than, the species now found in Syria and Palestine.

14. *Cervus* cf. *elaphus* Linn.

There are nine upper molars and premolars, some fragments of antlers, and a few limb bones of a large deer belonging to the *Cervus elaphus* group. The teeth are similar in size to those of a female specimen of *C. e. maral*, the large Eastern form of red deer of the present day.

Among the limb bones considered to be those of a red deer is a complete tibia 37 cm. in maximum length as compared with 40.5 cm. in a recent male specimen

of *C. e. maral.* With the exception of this tibia these remains are from the lowest layer.

15. *Dama mesopotamica* Brooke. (Text-fig. 9.)

Several fragments of upper and lower jaws containing teeth, and about a dozen

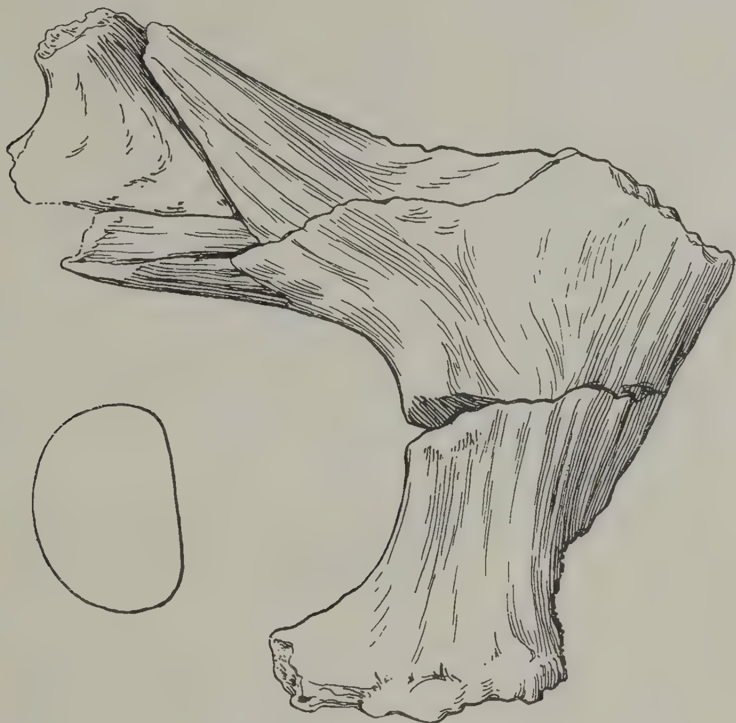

FIG. 9. *DAMA MESOPOTAMICA.* PROXIMAL PORTION OF RIGHT ANTLER AND SECTION, TWO-THIRDS NATURAL SIZE.

isolated teeth represent the Persian Fallow Deer. A few limb bones resembling specimens from Ksar Akil, near Beirût, probably also belong to this species.

Both Fritsch (1893, Pl. VIII) and Zumoffen (1900, Pl. XV) recorded this species, and figured teeth from Pleistocene cave deposits of Syria. In each case the identification was given with a query, for neither of these writers had the opportunity of examining the type-specimens which are in the British Museum, and seemingly no associated fossil antlers were obtained.

The material now available makes it possible to confirm this identification. In addition to the specimens from the Zuttiyeh Cave, others have lately been presented

to the British Museum by the American University of Beirût. These were obtained from the Late Palaeolithic Rock Shelter of Ksar Akil, near Beirût, and include a number of upper and lower jaws with teeth, the former of which agree with those of the type-specimen, which lacks the mandible. There are also several fragments of antlers, the most complete of which (B.M., M 13076) is shown in fig. 9. This is the proximal portion of a right antler, a shed specimen. The small brow tine is broken off, but appears to have been directed downwards. It will be noticed that the second tine is bifurcated, the inner face of the antler is very flattened and the extreme compression of the antler commences almost immediately above the burr, while 2½ inches above it the thickness is only 32 mm.

Sir Victor Brooke (1875, 1876, 1878) published a number of figures of recent antlers of this species, which show a great amount of variation. This is perhaps an indication of the approaching extinction of this fallow deer.

At the time of Canon Tristram's (1882, p. 407) first travels in Palestine in 1863-4, fallow deer were well known to the people of the country. Unfortunately he saw only one animal, which he was unable to identify. Palestine and Syria being not very far from Asia Minor and Western Persia, the present-day habitats of the two recent Damines, it is possible that further Pleistocene material may help to define more clearly the relationship of these two forms.

The distribution of the fallow deer was formerly much more extended, and more than one species has been obtained from the Norfolk Forest Bed, while the large *D. somoensis* is known from the Grimaldi Caves and other localities in France.

16. *Gazella* cf. *arabica* Lichtenst. sp.

Two species of gazelle are represented, as in the former collection from the Zuttiyeh Cave. Portions of nearly a dozen horn cores, a maxilla, and three mandibular rami resembling those already mentioned on p. 32, are probably those of a form of *G. arabica*. Two of the rami are of quite young animals. Most of these specimens are similar in colour to bones from the higher layers, but some appear to have been preserved in the phosphatic deposit, and others are stained with manganese dioxide.

17. *Gazella* cf. *subgutturosa* Gueldenst.

A frontlet with horn cores rounded anteriorly and less compressed laterally than those of the above-mentioned species may represent a form of this Eastern gazelle. This is the only specimen of gazelle undoubtedly obtained from the lowest layer. There are also a number of limb bones of gazelle, not specifically identified, some of which are from the occupation layers, others from the phosphatic deposit.

18. *Capra primigenia* Fraas, *non* gervais. (Text-fig. 10.)

As long ago as 1878 Fraas recognized the presence of two species of goat or

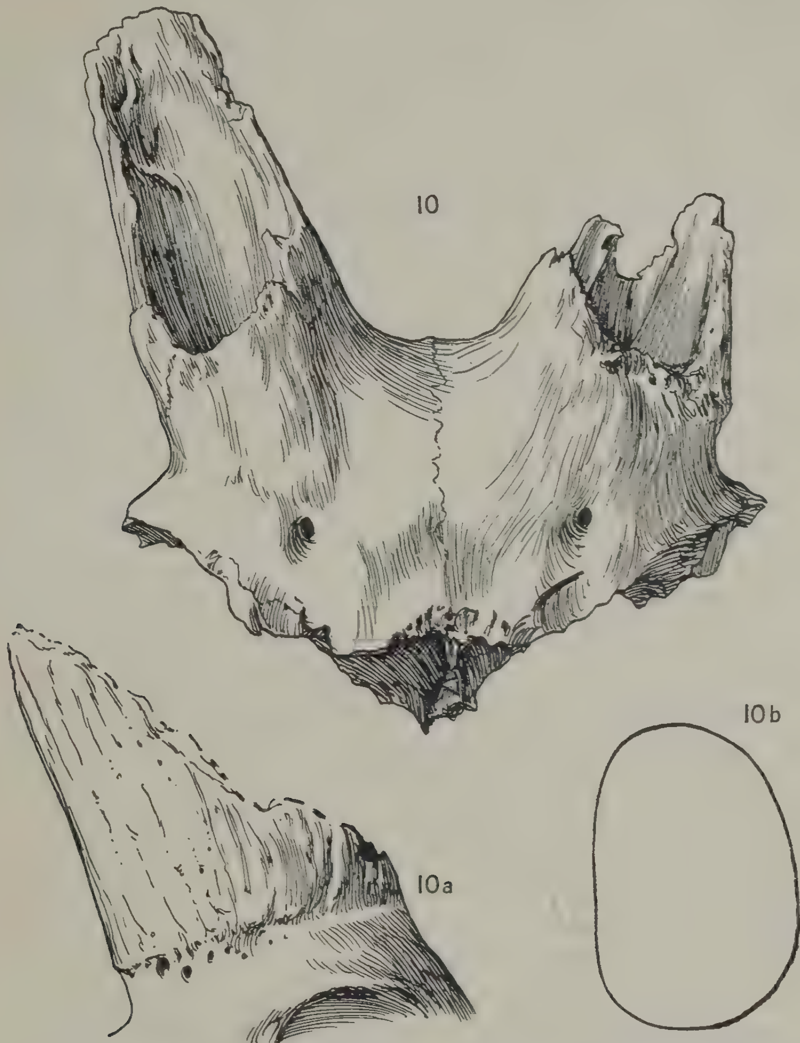

FIG. 10. *CAPRA PRIMIGENIA.* FRAGMENT OF SKULL WITH BASES OF HORN CORES.
,, 10A. SAME. EXTERNAL ASPECT OF BASE OF RIGHT HORN CORE.
,, 10B. SAME. SECTION; ALL TWO-THIRDS NATURAL SIZE.

ibex in the cave deposits of Syria; one was identified with the Arabian ibex of the country and the other, distinguished by its greater size, was named *C. primigenia*.

Fritsch (1893) had a great quantity of material from Syria including portions of over two hundred jaws of which he gave a detailed description, and both he and Zumoffen (1900, Pl. XV) published figures of the teeth.

Two maxillae in the present collection may belong to this large species; one contains the three premolars and the first molar, which have a maximum antero-posterior length of 41 mm., of which the premolars occupy 27 mm. The fragment of skull, including the basal portions of the horn cores, shown in fig. 10, is ascribed to *C. primigenia* with much more certainty. Except in size these horn cores closely resemble those of *C. nubiana*, which is still found on the borders of Palestine.

Fritsch (1893, p. 26) has already shown that the shape of the horn cores gives evidence for the relationship of *C. primigenia* with the ibex (" Steinböcken, *Capra* s. str.") and not with the wild goats (" *Hircus* "). He describes specimens from the Antelias Cave, near Beirût, as having an elliptical outline without a sharp anterior edge. The specimen figured here is similar in these respects, and the horn core is very flattened on the external surface, and slightly rounded on the internal one. A similar outline obtains in *C. nubiana*, but the reverse is the case in *C. hircus*, in which there is besides a sharp edge on the internal anterior border.

The right horn core has a maximum antero-posterior diameter of 67 mm. and a maximum width of 47 mm. These measurements in a fine recent specimen of *C. nubiana* from North Africa are 58 mm. and 43 mm. respectively.

19. *Bison* or *Bos*.

A dozen upper and lower molars and premolars of a large bovine, probably *Bison* or *Bos*, are from the lowest layer. Most of these are considerably larger than the corresponding teeth of the recent bison. It should be remembered, however, that the Pleistocene representative of a recent animal is frequently very much larger, so that size alone in isolated teeth seems of little value for purposes of specific determination. This has been interestingly brought out by Sir Arthur Smith Woodward (1924).

20. *Procavia* cf. *syriaca* Schreber.

Remains of a hyrax include two left maxillae, a left upper incisor, and an imperfect right mandibular ramus. From their appearance and state of preservation these specimens probably came from above the lowest layer. One of the maxillae, to which the premaxilla is attached, retains the complete row of cheek teeth, which has an antero-posterior length of 43 mm. This specimen is larger, but otherwise resembles the corresponding part in those recent skulls of *P. syriaca* with which I have been able to compare it. The upper incisor is also large and has a sharp,

median anterior ridge which denotes that it is that of a male animal (Thomas, 1892). In section it takes the form of an isosceles triangle, the posterior border measuring 6 mm. and the sides 5 mm.

This animal, which is the coney of the Bible, is not uncommon in Palestine according to Aharoni (1912), but it is seldom seen. It is now found as far north as the hills behind Tyre, from which locality there are specimens in the collection of the American University of Beirût. Formerly it ranged still farther north, for two imperfect left mandibular rami have been obtained from a cave deposit near Beirût by Mr. R. von Heidenstam of Débayeh.

These two instances seem to be the only records of the occurrence of *Procavia* in the Pleistocene of this region.

Worked Bones and Antlers

Among the specimens collected from the lowest layer of the Zuttiyeh Cave in 1926 there are a number of fragments of antlers and of limb bones of ungulates, bearing incisions and markings which are of considerable interest. Some of the markings may be the result of gnawing by Carnivora or Rodentia, but others cannot be accounted for in this way.

It will be remembered that no artefacts were obtained from this lowest layer, but, after all, this is only negative evidence and furthermore these earliest mammalian remains were procured from only a small portion of the whole area of the cave floor.

Dr. Henri Martin, who has studied the subject most carefully for many years, shrewdly remarks in one of his volumes (1907-10) that man did not attain all at once the skill shown in some of the worked bone implements and engravings of later times. There were early and crude ventures in the art of using flints for any purpose, and it is easy to overlook such workings, the object of which may be difficult to explain. Examples of such attempts may be represented on these bones and antlers from Zuttiyeh.

The Abbé Breuil, to whom I showed some of this material, was the first to draw my attention to these markings. He very kindly allows me to say that he is convinced that some of them are without doubt the handiwork of palaeolithic man. Four of the specimens are shown in untouched photographs in Pl. XVII, figs. 3-6.

Fig. 3 is probably a radius of a species of *Cervus*, and some short cross cuts and longitudinal striae can be clearly seen. These are not unlike examples figured by Dr. Martin (1907-10, Pl. XLVI).

More vigorous cross working is seen on the pedicle of the small antler (fig. 4), which is thought to be that of a juvenile *Dama mesopotamica*. The remaining two

specimens (figs. 5 and 6) are fragments of antlers of *Cervus ? elaphus*; the edges seem to indicate cutting and shaping for some purpose.

Future excavations in the caves of Palestine and Syria will probably reveal further material and yield more definite evidence on this subject.

Conclusion

The narrow strip of country which stretches over six degrees of latitude and is now known as Syria and Palestine is unique in religious, historical, and geological interest. Its fauna is no less interesting, and reflects the wonderful variety of climate, vegetation, and altitude in this comparatively small area.

Within the short distance of 120 miles the land surface ranges from more than 1,000 feet below the level of the Mediterranean on the shores of the Dead Sea to Mount Hermon, which rises 9,000 feet above the Mediterranean. The Emireh and Zuttiyeh Caves are situated little above the Sea of Galilee, which is nearly 700 feet lower than the level of the Mediterranean.

This diversity of land surface is reflected, not only in the present-day fauna, but also in the faunal assemblages of Pleistocene times. When it is realized that no single cave, or single layer of a cave, can possibly contain remains of the entire fauna of a country at a particular time, it will be admitted that the collections from the Emireh and Zuttiyeh Caves indicate the existence of faunas even more abundant than that of the present day. These collections together include remains of thirty-five species of mammals, a number of birds, and a few reptiles and amphibians.

Each of the three collections, one from the Emireh Caves and two from the Zuttiyeh Cave, includes species of both Palaearctic and African type. Earlier writers have laid great stress on the distribution and restriction of habitat of these various forms typical of the Palaearctic and Ethiopic regions. It has been maintained, more especially by Nehring (1902, p. 85; 1903, p. 51), that the faunas of Northern and Southern Palestine can be sharply separated by an imaginary line drawn from south of Mount Carmel to the southern border of the Sea of Galilee.

This does not seem to be supported by the distribution of the present-day fauna, and still less by that of Pleistocene times. Rather is there a natural and gradual decrease of southern and increase of northern forms as a more northerly latitude is reached. In this connection it is worth mentioning the distribution of the coney (*Procavia* sp.), which may be taken as one of the typical southern forms. It was formerly thought to be confined to the Dead Sea Basin, but is now known to live as far north as Tyre; it formerly occurred north of Beirût.

Among birds the Palestine sun-bird (*Cynnyris oseae*), belonging to a group otherwise only found in Africa and India, was believed to be confined to the Dead Sea Basin, the southern slopes of Mount Carmel, and near the Plain of Gennesaret. Its habitat is, however, far less restricted, for it is a well-known visitor to Beirût, where Professor and Mrs. Day have watched it in their garden during the middle of winter.

During Pleistocene times there was still less faunal separation between southern Palestine on the one hand and northern Palestine and Syria on the other. For instance, remains of *Hippopotamus*, *Rhinoceros hemitoechus*, and *Procavia* have been obtained in cave deposits of both Syria and Palestine.

One of the most interesting facts disclosed by the study of the animal remains from the Emireh and Zuttiyeh Caves is the definite association of *Hippopotamus* with a Middle Palaeolithic culture, and the probable association of *Rhinoceros hemitoechus* with a slightly later culture. This seems to point to the fact that there has not been any great faunal change in this region between the Mousterian and the following period. The fact that this rhinoceros is *R. hemitoechus* and that this species also occurs in Syria is highly important, emphasizing the absence of evidence of a so-called cold fauna.

Below the Middle Palaeolithic occupation layers of the Zuttiyeh Cave " African " types are represented by the spotted hyaena (*H. crocuta*) and perhaps by a river hog (*Potamochoerus*), these were associated with a large form of brown bear (*Ursus arctos*), a typically Palaearctic animal.

I should like to take this opportunity of expressing my thanks to Professor J. Garstang and to Mr. Turville-Petre for giving me the opportunity of studying these interesting collections. I am also indebted to Dr. F. A. Bather, F.R.S., Keeper of Geology, British Museum, for giving me facilities for carrying out this work, and to Mr. M. A. C. Hinton for help in the identification of some of the specimens. My thanks are also due to Miss G. M. Woodward for her careful execution of the text-figures, and to Mr. E. D. Mountain for making the chemical analysis of the matrix on some of the specimens.

EXPLANATION OF PLATE XVII

Fig. 1. *Sus* sp. Left Maxilla, internal lateral view.

Fig. 2. *Sus* sp. Same, crown view.

Fig. 3. ? *Cervus* sp. Radius, showing longitudinal markings.

Fig. 4. ? *Dama mesopotamica* Brooke. Pedicle of right Antler showing transverse markings.

Fig. 5. *Cervus* ? *elaphus* Linn. Worked fragment of Antler.

Fig. 6. *Cervus* ? *elaphus* Linn. Worked fragment of another Antler.

Specimens from Mugharet-el-Zuttiyeh, 1926.

All figures are of natural size.

PLATE XVII

H. G. Herring, photo.

MAMMALIAN REMAINS FROM MUGHARET-EL-ZUTTIYEH, 1926.

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SECTION IX

REPORT ON THE GALILEE SKULL

By Sir Arthur Keith, F.R.S., M.D.., F.R.C.S.

(*Conservator of Museum, Royal College of Surgeons of England*)

IN the previous part of this publication an account has been given of the finding of the Galilee skull and of the evidence relating to its antiquity. The skull was found in the deepest part of an undisturbed stratum containing implements closely resembling those of the Mousterian culture of Europe, and we may presume that it is representative of the people who lived in Palestine when the cave floor was being deposited, and when the culture of the people had reached the stage which is represented in the cave of Le Moustier in the Dordogne region of France. This is the first time human remains of Mousterian date have been found outside the limits of Europe. The interest of the discovery is enhanced by the place in which it was made—in Palestine, to the west of the Sea of Galilee.

PART I

Concerning the Characters of the Cranial Fragment

The parts of the skull found were: (1) an almost complete frontal bone; it had become separated from the missing parts of the original skull along the coronal suture. The skull must have been that of a young person, certainly under thirty years of age, probably under twenty-five years, for there was no bony union along the coronal suture, which is seen to be perfectly intact—all save at the lower (sphenoid) angle of the left side, where a small fragment had been broken away. Parts of both orbital roofs had also been broken away and are missing, but the nasal or interorbital process of the frontal is almost entire, and to it adhere (*a*) the upper part of the right nasal bone, (*b*) part of the frontal process of the right maxilla, (*c*) a small fragment of the left nasal bone (see fig. 12). On the left side the region of the dacryon had been broken away, but it is present on the right side. As will be seen in

fig. 23 the frontal sinuses are laid open and several of the ethmoidal air sinuses are preserved. The crista galli remains *in situ*, having attached to it a fragment of the vertical plate of the ethmoid (fig. 21). On each side the frontal bone preserves the sutural impression for the sphenoid and zygomatic (malar) bones (fig. 21). Besides the frontal bone there was also found (2) the right malar bone of the same skull (fig. 11). The fronto-malar suture is quite ununited but at the malo-maxillary suture, bony union has occurred, there remaining attached to the malar a fragment of the wall of the maxillary sinus (see fig. 12, L). (3) The great wing and small wing of the sphenoid of the right side were also found (figs. 11, 12). These make a perfect fit with the sutural impressions on the frontal bone. Attached to the great wing of the sphenoid is the root of the right pterygoid process and part of the body of the sphenoid containing an extension of the sphenoidal air sinus (fig. 11). Part of the body of the sphenoid bears the impress of the right carotid artery and extends to within 5 mm. of the mid line of the skull (fig. 20). All the sutures had remained open and free at the time of death, save the malo-maxillary. We may infer that the person was not over twenty-five years of age.[1]

The frontal, malar, and sphenoid bones show features which are never met with in the corresponding bones of modern or neanthropic man. Wherein they differ from the bones of neanthropic man they agree with those of Neanderthal man. There can be no hesitation in assigning the person represented by the Galilee skull to the Neanderthal species of mankind and yet, as we shall see, there are details in which the Galilean type differs from the Neanderthal varieties which have been discovered in Europe hitherto. How far these details are merely of an individual nature, how far they are representative of another race, cannot be discussed with profit until further and more complete examples of the Galilean type have been discovered. This discovery, however, does serve to prove that men of the Neanderthal species extended beyond the bounds of Europe and that in the East, as in Europe, their culture was of the Mousterian kind.

We shall see that the supraorbital development—the *supraorbital torus*—is relatively massive in the Galilee skull, and in my earlier investigations, because of this development, I looked upon the skull as that of a man. Further comparisons with the Neanderthal specimens of Europe and the comparisons of these with one another have led me to alter my opinion. Apparently in both men and women of the Neanderthal species there was a massive development of supraorbital ridges; on the evidence at present available one is led to infer that it is the total mass of skull which is the best criterion of sex in the Neanderthal species. Only further

[1] As to the dates at which the sutures of the human skull close see Prof. T. Wingate Todd's investigations (*Amer. Journ. Physical Anthrop.*, 1925, vol. viii, p. 23).

discoveries can settle the point, but in the meantime I think it safer to regard the Galilee skull as that of a woman rather than that of a man. My reasons will become more apparent as I proceed to discuss the various cranial features.

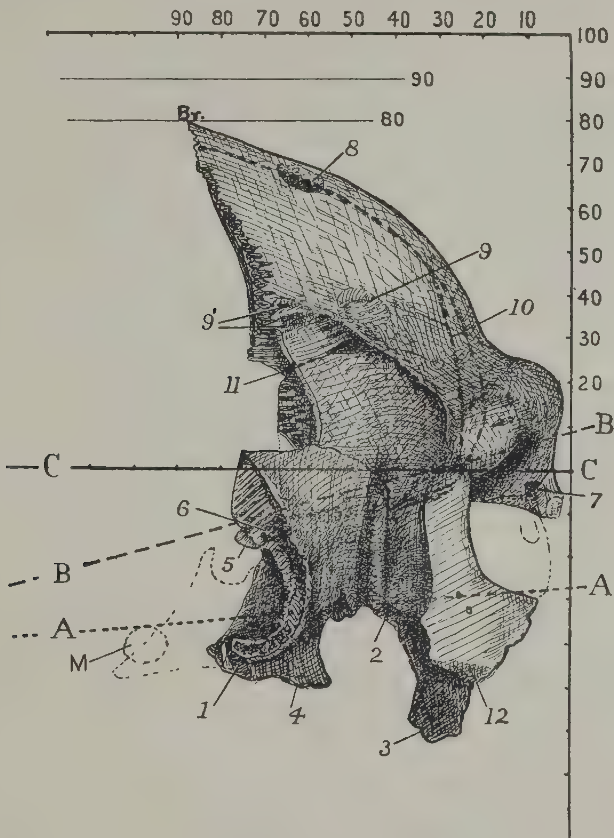


FIG. 11

A preliminary drawing of the Galilee fragment, as seen in true profile and made to scale. The fragment has been oriented on the plane C C which passes through the fronto-malar suture, the bregma (Br) being placed 80 mm. above this plane. B B. The true position of the sub-cerebral plane. A A. Supposed position of the Frankfort plane. (1) Foramen ovale, represented by an open notch; (2) anterior end of spheno-maxillary fissure at lower end of spheno-malar suture; (3) fragment of wall of sinus maxillaris attached to malar; (4) root of pterygoid process; (5) anterior clinoid process; (6) position of optic foramen; (7) facet from which the frontal process of maxilla has been removed; (8) the oval depression or erosion on outer aspect of frontal; (9) cicatricial depression above temporal ridge; (9^1) upper and lower division of temporal ridge at stephanion; (10) internal frontal crest and inner surface of frontal in sagittal plane (broken lines); (11) fracture caused by workman's pick; (12) masseteric impression on malar and malo-maxillary suture. In this as in all other illustrations the scale is marked on the framework of lines which surround the drawing, the measurements being stated in millimetres.

There is one other matter which may be discussed here, before proceeding to describe and depict the various aspects of this cranial fragment. How did the skull come to lie where it was found by the excavators? The bones are marvellously well preserved; they are as hard as porcelain, and when struck give out a metallic resonance. They can be handled with the greatest impunity—almost as if they were made of cast iron. One cannot conceive that the rest of the skull could have perished and disappeared in its resting-place when the parts found are so perfectly preserved. One may be certain that there never was a complete skull at the site of discovery; only a stray fragment had become entombed, and I see no reason to suspect that the burial was designed. It is not uncommon, when excavations are made on sites where men have lived in former times, to come across single bones of the human skeleton or fragments of a human skull. I am inclined to look on such isolated bones as stray fragments which have become accidentally covered over and thus entombed. It is in such a manner that I suppose the Galilee skull to have become embedded in the palaeolithic level of the cave floor.

With only the frontal region of a skull at his disposal the craniologist has certain novel problems to solve before he can reach an opinion as to the kind of person represented by it. What was the slope of the forehead in the living head? To settle this matter I made the preliminary drawing, shown in fig. 11, where the parts are drawn in true profile and to scale—the original being made exactly natural size. As the Galilee frontal bone had so many points of resemblance to that of the Gibraltar skull—which is certainly of the Neanderthal type—I gave to the frontal bone, before I drew it, the same degree of tilt as is seen in the Gibraltar skull when that specimen is oriented in what I have named the sub-cerebral plane. In fig. 11 the line C C represents the sub-cerebral plane. In front it passes through the mid point of the fronto-malar suture, as seen on the lateral aspect of the skull. Behind, the sub-cerebral plane crosses the mid point of the masto-parietal suture, corresponding approximately to the attachment of the tentorium cerebelli, thus separating the cerebral part of the cranial cavity above, from the cerebellar cavity below. In front, the sub-cerebral plane makes, on most skulls, a near approach to the level of the floor of the anterior fossae, as represented by the cerebral aspect of the small wings of the sphenoid. This plane will be found of great utility in dealing with fragmentary skulls, for the external angular (malar or zygomatic) process of the frontal is usually preserved or, if missing, can be located with a considerable degree of precision. When the Gibraltar skull is oriented on this plane, the bregma (highest point) of the frontal bone lies 82 mm. above the level of the fronto-malar suture. In fig. 11 it will be seen that in my preliminary investigation of the Galilee fragment the bregma of the frontal is situated 80 mm. above the level of the fronto-malar suture, 2 mm. less

than in the Gibraltar skull. As my drawing was proceeded with, on the lines represented in fig. 11, it soon became manifest that the Galilee frontal was much less receding, more lofty, than I had presumed. I found that the upper margin of the great wing of the sphenoid—the alisphenoid—at the region of the pterion rose only 5 mm. above the sub-cerebral plane (fig. 11), whereas in skulls of the Neanderthal type it usually lies 15 mm. above this plane, and in those of the modern or neanthropic type it usually rises from 20 to 25 mm. above this plane. Further, it will be seen from fig. 11 that the upper surface of the small wings or orbito-sphenoid—planum sphenoidale—in place of being about the same level as the sub-cerebral plane was 13 mm. below it (fig. 11). When the frontal bone was tilted forwards, so that the bregma rose 92 mm. above the level of the fronto-malar suture all these anomalies disappeared (compare figs. 11 and 13). It was thus manifest that the forehead of the Galilee person was much less receding than I had presupposed, that the bregma rose at least 92 mm. above the sub-cerebral plane, 10 mm. more than in the Gibraltar skull. For a skull of the Neanderthal type it was lofty, in this respect resembling neanthropic or modern skulls. In the La Chapelle skull the corresponding height of the bregma is 88 mm.; in Spy I, 81 mm.; in Spy II, 98 mm.; in the Neanderthal skull, 90 mm.; in Krapina C, 84 mm.; in the Rhodesian skull, 90 mm. Presently I shall compare the recession of the forehead by the methods which have been adopted by other craniologists. It is enough for the present to say that the vault of the Galilee skull was high and that the forehead was much less receding than is usual in skulls of Neanderthal type.

In my preliminary investigation as represented in fig. 11, I attempted to fix the position of the Frankfort plane. The whole of the right malar being present we know the lower border of the orbit, which marks this plane on the face of the skull. Enough of the body of the sphenoid is present to guide one to fill in a theoretical line which gives the position of the basilar process and basion (fig. 11). The external meatus, which gives the level of the Frankfort plane behind, holds a very constant relation to the basilar process of human skulls, a relationship which is depicted in fig. 11. Besides, one has other guides to the position of the external auditory meatus. I have placed its centre 20 mm. behind the posterior lateral angle of the alisphenoid—that is a maximum distance, but as we shall see there are other relationships and measurements by which we can check the position of the meatus. In fig. 1 the Frankfort plane is indicated by the line A A, and when this was drawn I was surprised to note that the cerebral surface of the alisphenoid, which represents the floor of the middle fossa, fell 6 mm. below the level of the Frankfort plane (fig. 11). Now in primitive human skulls the middle fossa is often situated a few millimetres above the level of this plane, but never, so far as I know, below it. Even in ultra modern skulls the floor of the middle fossa very rarely descends more than a milli-

metre or two below this plane. It is a safe rule to regard the Frankfort plane as corresponding to the deepest part of the fossa occupied by the temporal lobes of the brain. In searching into the meaning of the low position of the floor of the middle fossa on the Galilee skull, as depicted in fig. 11, I found that it was the result of an error on my own part. Wishing to preserve the sutural lines intact and exposable,

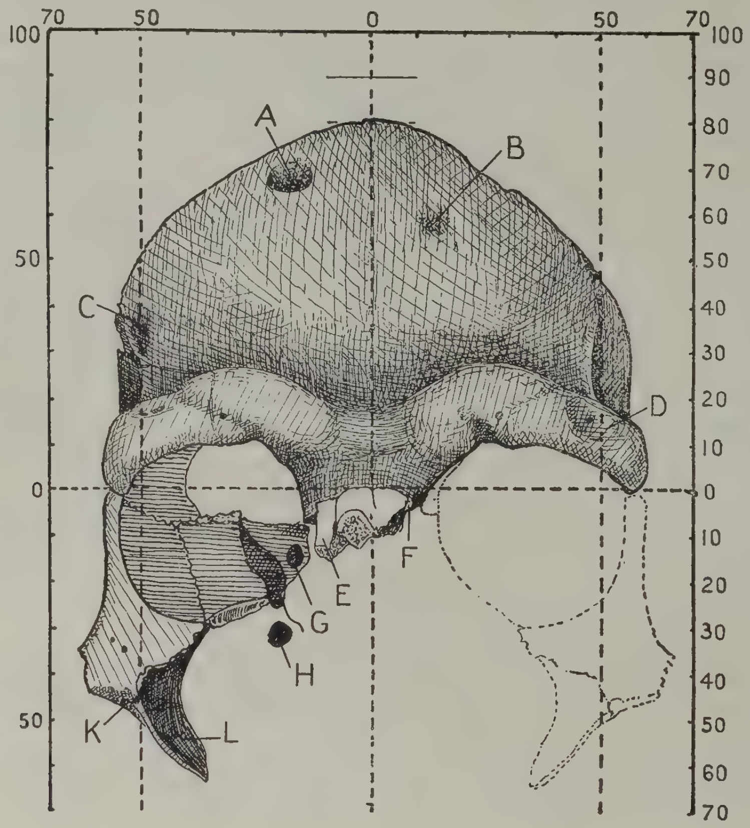


FIG. 12

The frontal aspect of the Galilee skull, drawn in the plane represented in fig. 11, and employed during the preliminary examination of the skull. The aspect presented is very nearly that which would be seen were the skull placed in the Frankfort plane. The drawing also serves to show the characters of the supraorbital ridges and the parts of the nose which remain attached to the interorbital or nasal process of the frontal. A. The larger of the depressions on the outer aspect of the bone, where the diploe of the bone has been exposed by an accident, operation, or disease during life. B. A healed or cicatrized depression. C. Another healed depression. D. A flattening over the outer aspect of the malar process of the frontal caused by the pressure of an overlying block of stone. E. Nasal process of right maxilla. F. Minute fragment of the corresponding process of the left maxilla. G. Optic foramen. H. Foramen rotundum. K. Masseteric impression at malo-maxillary junction. L. Fragment of wall of sinus maxillaris. The numbers indicate millimetres.

I used plasticine to keep the sphenoid in its propeı relation to the frontal. Somehow in setting up the fragments into position, preparatory to making my drawing, the

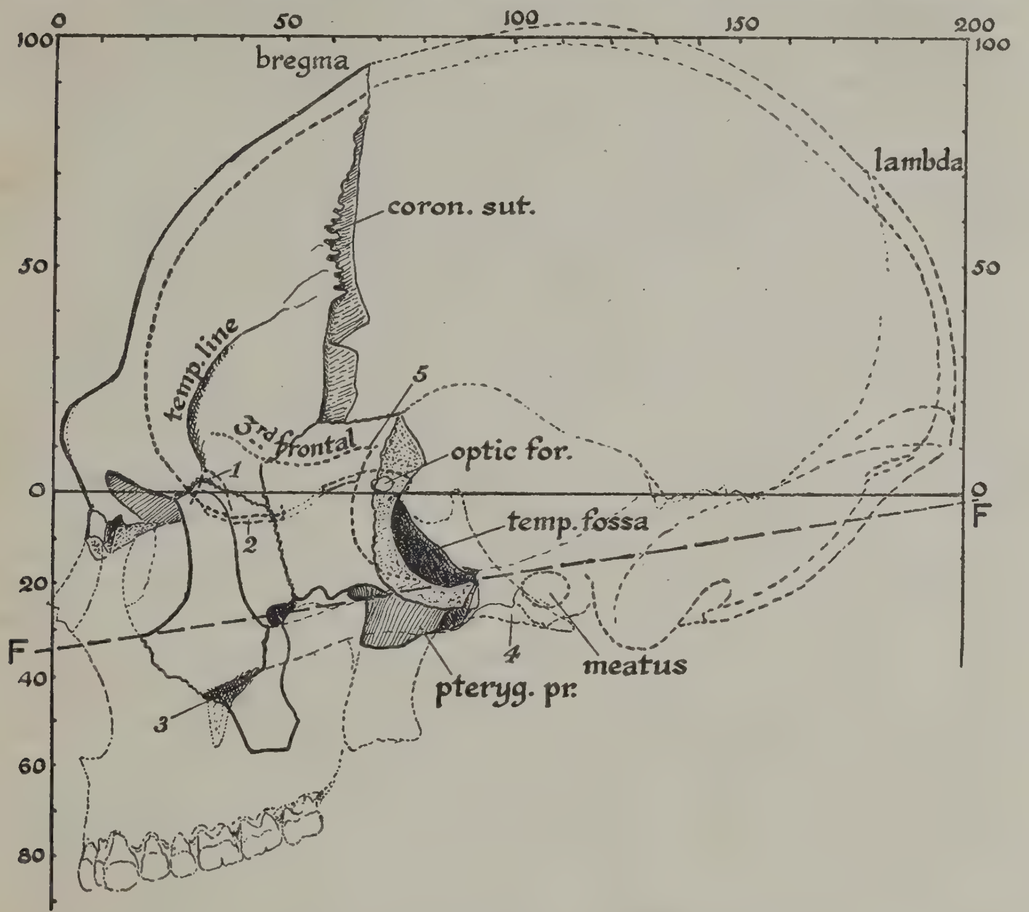


FIG. 13

The Galilee skull, oriented on the sub-cerebral plane and placed within a frame of lines designed to hold a skull which is 200 mm. in length, with a vault which rises 100 mm. above the sub-cerebral plane. The missing parts of the skull are represented by stippled lines. The interior of the frontal bone is depicted by a broken line. (1) Crista galli, situated behind the fronto-malar suture. (2) Position of the cribriform plate. (3) Masseteric impression on malar. (4) Basilar process. (5) Anterior margin of the middle fossa (fossa for temporal lobe, "temp fossa") which fits within and fills the Sylvian depression between the frontal and temporal lobes of the brain.

inner support of plasticene had yielded, allowing the sphenoid to swing laterally and thus assume an abnormally low position. These matters I mention to show that in the construction of human skulls there are certain relationships which serve as

checks and which help to guide us to the characters possessed by the skull when it was intact.

Fig. 11 also serves to show the dimensions and characters of the Galilee fragment when viewed and drawn in true profile. In Plate XVIII is given a photograph from the same aspect, and if a tracing of the drawing be superimposed on the photograph the reader will realize how much even the best of cameras distorts the relative proportions of the object it represents. On the other hand, photographs serve an excellent purpose in reproducing all surface markings and texture. From the photograph, as from the drawing, it will be noted that malar and alisphenoid differ in shape and in dimensions from the corresponding bones of neanthropic skulls; they are exactly similar to the same bones in the Gibraltar and Krapina skull C—the only Neanderthal skulls in which these bones have remained intact.

In fig. 12 I have reproduced the full-face drawing I made of the Galilee fragment when it was poised as shown in fig. 11 during my preliminary investigation. The drawing serves to show certain of the more striking features of the supraorbital region, but my chief object in reproducing it is the further evidence which it reveals that in my preliminary examination I placed the frontal bone in a too receding position. It will be seen that the optic foramen (fig. 12, G) is situated in the lower inner quadrant of the orbit, whereas in all skulls oriented in the true sub-cerebral plane, these openings appear in the upper and inner quadrant of the orbit. The foramen rotundum (fig. 12, H) in place of being well above the lower margin of the orbit is more than 5 mm. below it. All these anomalous relationships disappear when the frontal bone is tilted forwards, so that the bregma rises above the 90 mm. horizon and when the alisphenoid is restored to its true distance from the mid line of the skull. By such means I was able to determine the angle at which the frontal bone was placed in the original skull and the slope of the forehead as it appeared in the living head.

In fig. 13 the Galilee fragment has been oriented on the sub-cerebral plane, as determined in my preliminary investigation, and the alisphenoid given its proper place as regards the sagittal plane of the skull. All parts have been transposed so as to represent the left side of the skull, for it is convenient that we should represent ancient skulls from the same side so as to facilitate comparisons by superimposition of tracings; for many years I have been in the habit of representing them as seen on their left aspect. I have used all available Neanderthal skulls—Gibraltar, La Chapelle, Spy I and II, La Quina, and Krapina—in filling in missing parts, making these proportionate to the preserved parts of the Galilee skull. On such data I have made good the missing basilar process and auditory meatus, placing the centre of the latter 15 mm. behind the spine of the alisphenoid, which is a minimum amount.

It may have been situated a millimetre or two farther back; certainly not farther forward. We are thus able to indicate the Frankfort plane with a reliable degree of precision; we have also data for the plane used by the late Professor Gustav Schwalbe —a plane passing from glabella to inion. Having obtained these planes we are in a position to see how the Galilee skull stands to other specimens of the Neanderthal type.

One of the chief objects we have in view in studying the skulls of ancient races of men is to arrive at a knowledge of their cerebral development as represented by the mass of their cerebral hemispheres. We may regard the floor of the cerebral chamber, represented by the anterior and middle fossae, and by the tentorial roof of the hinder fossa, as a foundation on which cerebral expansion takes place. As the cerebral hemispheres increase in size, they may expand forwards, backwards, or push the walls of the skull sideways, but their easiest direction of expansion is towards the vault of the skull; with each step in evolution the vault of the skull tends to be lifted farther and farther away from the floor. Hence it is that in all our investigations we are constantly alive to the need of a method for stating the height of the cerebral roof represented by the vault of the skull. The three bases at present in use are the Frankfort plane, Schwalbe's plane, and the one I prefer, the sub-cerebral. There are two points in the cranial vault which concern us now—the bregma and the highest point of the vault, highest above such plane as we may adopt. The Frankfort plane, although adopted without any consideration of its relationships to the brain, has a fairly constant relationship to the floor of the cerebral chamber. In the Galilee skull the bregma lies 116 mm. above the Frankfort plane; in the Gibraltar skull it is only 98 mm.; in La Chapelle skull it is 109 mm.; in Spy I, 107 mm.; in Spy II, 120 mm.; in Krapina D, 110 mm.; in the Rhodesian skull, 109 mm.; in European skulls 114-118 mm. are common heights for the vault. Thus in point of bregmatic height the Galilee skull is exceeded, among Neanderthal skulls, only by Spy II; in this respect it resembles the condition found in modern races. A low flat roof is a prevailing character of Neanderthal skulls, but there are exceptions, of which the Galilee skull is a remarkable one. As regards the height of the bregma above the glabella-inion, or Schwalbe's plane, mention must be made, as previous enquirers have concerned themselves with it. In the Galilee skull the bregma is 81 mm. above Schwalbe's plane; the corresponding measurement in the Gibraltar skull is 73 mm.; in La Chapelle, 77 mm.; in Krapina D, 76 mm.; Spy I, 72 mm.; Spy II, 84 mm.; Neanderthal, 86 mm.; Rhodesian skull, 82 mm. The glabella-inion plane is most unsuitable for the comparison of primate skulls for the following reason. As the skull grows and the animal matures, both inion and glabella ascend on the wall of the cranial cavity. In the skulls of Neanderthal man

they ascend to a higher level—higher by 5 to 10 mm.—than in the skulls of modern man. If we use such a base line for estimating the height of the cranial vault and degree of cerebral development we obtain a misleading result in the case of Neanderthal man.

In estimating the cerebral development of any higher primate from an examination of the skull there is one point particularly worthy of consideration. When the skull of an anthropoid ape is oriented on the sub-cerebral plane and drawn in profile as in fig. 13, the bregma is situated at the highest point of the cranial vault. This is still the case in Pithecanthropus and almost the case in the Rhodesian skull. In skulls of modern races, on the other hand, the highest point is situated on the parietal part of the vault, 30 to 50 mm. behind the bregma. This tendency for the highest point of the vault to be transferred to the parietal region of the vault is due to the development and expansion of the upper Rolandic and post Rolandic areas of the brain which are concerned in movements of the trunk and lower limbs; we have in the elevation of the parietal area of the vault a character of real significance.

It will be seen from fig. 13 that I suppose the highest point in the vault of the Galilee skull to rise 10 mm. above the level of the bregma—the highest point being about 102 mm. above the sub-cerebral plane and 118 mm. above the Frankfort plane. That the vault had such an elevation I infer from the height of the bregma and particularly from the upward spring of the highest part of the frontal bone. I have also been influenced by the contour of the vault in the Neanderthal skull known as Spy II. In it the highest point rises 106 mm. above the sub-cerebral plane —8 mm. above the level of the bregma. In the Gibraltar skull the highest point is not more than 87 mm. above the sub-cerebral plane—15 mm. less than I suppose to be the case in the Galilee skull. In La Chapelle skull the vault reaches 100 mm. at its highest point, almost the same as is usual in the average British modern skull, in which the auricular height of the vault is 114 to 115 mm. If such an average skull is placed in the framework represented in fig. 13, the highest point of the vault reaches the upper horizontal line, which lies 100 mm. above the sub-cerebral plane. Thus in height of vault the Galilee skull resembles modern skulls; it was not low and flat-domed as is the case in all typical examples of Neanderthal skulls. The pre-eminence of the parietal region of the vault is not observed if skulls are oriented on the Frankfort plane. My friend Professor Wingate Todd has shown that in this plane the bregma and Rolandic point of the vault are, in the average European skull, on the same level.

As to the total length of the original Galilee skull one infers that the missing parietal and occipital bones, as regards length, held an average proportion to the frontal bone, the average computed from known examples of Neanderthal skulls.

Hence I infer that the original length of the entire skull was about 195 mm.; it was more than 190 mm. and less than 200 mm.

Up to this point I have been dealing with the steps I took to determine the slope

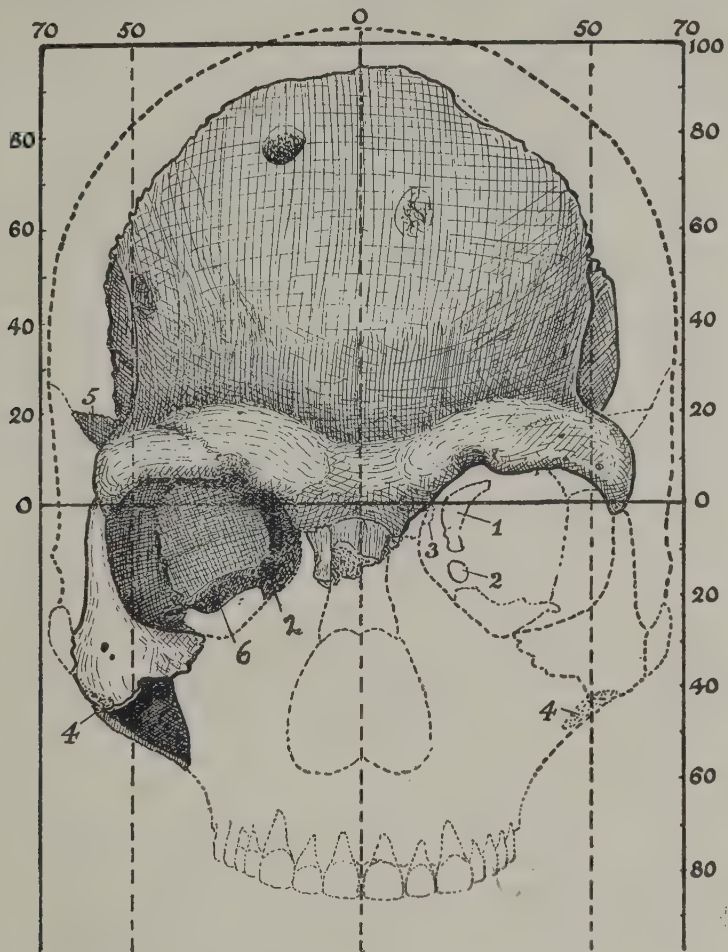


FIG. 14

Full face view of the Galilee skull drawn in the sub-cerebral plane. The missing parts are represented by stippled lines. (1) Sphenoidal fissure; (2) foramen rotundum; (3) optic foramen; (4) masseteric impression at lower end of malo-maxillary suture; (5) alisphenoid; (6) groove for zygomatic branch of maxillary division of fifth nerve.

of the frontal bone of the Galilee skull, the height of its vault, and its original length. I now turn to the data we have to guide us to its original width. In fig. 14 a full-face drawing of the Galilee fragment is given; it has been drawn at right angles to

the view given in fig. 13, in both cases the skull being oriented on the sub-cerebral plane. We are at once struck by the width of the supraorbital ridge or torus of the frontal; it measures from one angular extremity to the other 119 mm., being the widest part of the frontal bone. The maximum width of the brain-containing part of the frontal is only 113 mm. These two measurements may be described as antagonistic, for the more primitive or ape-like the skull the wider is the supraorbital measurement and the narrower the cerebral frontal width. We must recognize in the frontal bone two functional elements—one concerned in enclosing and protecting the brain—a cerebral element, and the other, or supraorbital, which is part of the facial skeleton and is concerned chiefly in mastication. The supraorbital ridges are also influenced in their development by the conditions which regulate the growth of secondary sexual characters. In the meantime we note the relatively great supraorbital development as a primitive feature of the Galilee skull. The frontal bone has a small cerebral width and a great supraorbital measurement.

It will be noted that the supraorbital width of the Galilee skull is 6 mm. more than its maximum cranial or cerebral width. In the skulls of male aborigines of Australia (taking the mean of ten skulls) the supraorbital width is 112.6 mm.; the "maximum frontal" width 111.9 mm., the former exceeding the latter by a fraction of a millimetre. The following are the corresponding measurements of other races—the amounts representing the mean of measurements made on ten skulls—Chinese, 100.7 mm., 116.5 mm.; West African negroes, 109.4 mm., 118.9 mm.; British males, 106.8 mm., 122.3 mm.; Bushmen, 105 mm., 112.8 mm. If we take the British as representative of modern Europeans we see that the maximum frontal exceeds the supraorbital width by 15.5 mm.; in the Galilee skull a reverse condition prevails; the supraorbital width is the greater by 6 mm. We see, when the figures given above are examined, that in the evolution of human races there has been a marked increase in the cerebral width of the frontal and an equally marked reduction in the supraorbital widths. The only living race to show a predominance in the supraorbital width are the Australian aborigines.

The predominance of the supraorbital width is a usual feature of Neanderthal skulls as the following list of measurements will illustrate. In the Gibraltar skull the supraorbital width is 118 mm., the "maximum frontal" width, 120 mm.; the corresponding measurements in La Chapelle skull, 124 mm., 122 mm.; in the Neanderthal Calvaria, 122 mm., 122mm.; Spy I, 125 mm., 114 mm.; Spy II, 124 mm., 117 mm.; Rhodesian skull, 139 mm., 118 mm. It will be seen that the Rhodesian skull holds the record for supraorbital width—139 mm.—21 mm. more than its maximum frontal width. The Gibraltar skull, although primitive in many of its characters, yet, in this respect, goes into the higher group, for its maximum

frontal exceeds the supraorbital width by 2 mm. It is the opposite in the La Chapelle skull, where the supraorbital width exceeds the maximum frontal by 2 mm. In the Neanderthal skull the two measurements are equal. In the larger Neanderthal skulls the supraorbital width reaches to about 125 mm., whereas in the smaller this measurement falls under 120 mm. It seems most probable that the smaller skulls are those of females. In the Galilee skull the supraorbital width is 119 mm., and this is one of the reasons for my leaning towards the belief that it is a woman's skull. Nevertheless, it is remarkable for the amount to which the supraorbital width exceeds the maximum frontal width. This relationship must be regarded as one of a primitive or Simian kind.

The minimal width of the Galilee frontal is 97 mm.—measured above the supraorbital torus, where the temporal ridges make their nearest approach to each other. This width depends on two antagonistic factors. There is, in the first place, the absolute width of the brain-containing part of the bone, and there is, in the second place, the thickness and the position of the temporal ridges, the latter depending upon the degree to which the temporal muscles of mastication have been developed. The width of forehead as thus measured may mean wide frontal lobes or it may only signify a great development of temporal ridges. In the case of the Galilee skull, the considerable width of 97 mm. is due in part to a great masticatory development. The corresponding measurement (minimal frontal width) in the Gibraltar skull is 102 mm.; in La Chapelle, 109 mm.; in the Neanderthal skull, 107 mm.; Spy I, 104 mm.; Spy II, 106 mm.; La Quina, 90 mm.; Krapina D, 110 mm.; Krapina C, 98.5 mm.; in the Rhodesian skull, 98 mm. In modern male Australian aborigines (mean of ten skulls) the minimum frontal diameter is 98.8 mm.; West African negroes, 99.5 mm.; British males, 99.1 mm.; Punjabis, 99 mm.; Bushmen, 97.8 mm. Thus it will be seen that compared with other Neanderthal skulls, the Galilee had a small frontal width, the only example which falls lower is La Quina, and that is regarded as certainly the skull of a Neanderthal woman.

What was the maximum parietal width of the Galilee skull when it was entire? We have the following data to guide us: (1) the minimal width of the frontal bone, 97 mm.; (2) its width at its most contracted part behind the outer ends of the supraorbital processes, 98 mm.; (3) its width where the temporal lines cross the temporal ridges—bistephanic diameter, 111 mm.; (4) the maximum width of the frontal, 113 mm.; (5) the extreme bisphenoidal width, 124 mm. We are able to obtain the latter measurement because of the presence of the right alisphenoid (figs. 14, 15); the hinder end of the upper or parietal margin of the alisphenoid is 62 mm. distant from the sagittal plane; we may presume that the width of the original skull at this point was about $62 \times 2 = 124$ mm. The most valuable of these

measurements, to serve as a guide to the maximum biparietal width, is the maximum frontal width, which is very small—only 113 mm. There is no doubt we are dealing with a skull of the Neanderthal type; therefore, our first enquiry is into the relationship which the maximum frontal width holds to the maximum biparietal width in this type of skull. In the Gibraltar skull the maximum frontal width is 118 mm., its maximum biparietal 142 mm.; the latter is 24 mm. more than the former; to obtain the biparietal width we have to add $\frac{24}{118} \times 100 = 20.3$ per cent. to the bifrontal width. If we make such an allowance to get the maximum width of the Galilee skull we obtain this result: 20 per cent. of 113 mm. = 22.3 mm., giving a maximum width of 135.6 mm. In the La Chapelle skull the maximal frontal width is 122 mm., the maximal biparietal 156 mm., the latter exceeding the former by 34 mm., which excess represents almost 28 per cent. of the bifrontal width. If we add 28 per cent. to the bifrontal width of the Galilee skull we obtain a biparietal width of $113 + 31.6 = 144.6$ mm. In the original Neanderthal skull the bifrontal diameter is 122 mm., the biparietal 147 mm., the latter exceeding the former by 25 mm., or 20.5 per cent. The corresponding figures for Spy I are: 114 mm., 140 mm., 26 mm. = 22.8 per cent.; for Spy II, 117 mm., 150 mm., 33 mm. = 28.2 per cent. It will be observed that in the two massive big-brained skulls, La Chapelle and Spy II, 28 per cent. had to be added to the bifrontal diameter to obtain the biparietal, while in the smaller-brained skulls the addition varies from 20.3 to 22.8 per cent. Now compared with other Neanderthal specimens the frontal bone of the Galilee skull is narrow and particularly high, especially when its maximum width is taken into consideration. There is not any suggestion in the vaulting of its frontal bone that the roof of the skull was low and flat as is usual in Neanderthal skulls. We may therefore presume that if we add 22 per cent. to the bifrontal diameter we shall obtain an approximate estimate of the original biparietal width. That estimate gives us 113 mm. + 24.8 mm. = 137.8 mm. or 138 mm. In the La Quina skull, which is certainly that of a Neanderthal woman, the maximum biparietal width was 140 mm.; with this skull the Galilee has many points of resemblance.

Thus it will be seen that an examination of the data available leads towards the conclusion that the Galilee skull when intact had a total length of about 195 mm., a maximum width of about 138 mm., and that the vault of the skull, at its highest point—when the skull was oriented on the Frankfort plane—was situated about 118 mm. above the external auditory meatus. It was a long and narrow skull, the width being about 70 per cent. of the length, and compared with other Neanderthal skulls, particularly when the width is taken into consideration, relatively high in the vault. If we apply to these dimensions the Lee Pearson formula for obtaining volume of brain in female skulls—$L. \times W. \times H. \times 0.4 + 206$—we obtain an estimated

cranial capacity of 1,475 cubic centimetres. If we apply their formula for male skulls—L. × W. × H. × .337 + 406—we obtain an estimate of 1,470 cubic centimetres. The true estimate owing to the glabellar projection is probably considerably less, between 1,350 and 1,450 cubic centimetres. This is a moderate capacity for a Neanderthal skull, and makes another factor which leads me to regard the Galilee skull as that of a woman.

The Supraorbital Torus.

Having thus made an attempt to obtain a reliable estimate of the dimensions and form of the original Galilee skull, I now turn to an examination of the parts which are available for direct study. The supraorbital ridges, or torus, provide one of the most characteristic features of Neanderthal skulls. The supraorbital region of the Galilee skull is shown in figs. 12 and 14. In these drawings, and also in the photograph shown in Plate XIX, it will be seen that a slight groove or furrow separates the two elements which make up the torus—the inner or supraciliary from the outer or supraorbital. This groove commences above and external to the break or notch at which the supraorbital nerve makes its escape from the orbit. From the region of the notch the groove passes upwards and outwards, vascular openings marking its course. There are two of these near the outer extremity of the groove, as well as another at its commencement outside the supraciliary notch. Such foramina appear in most examples of Neanderthal skulls. Each supraorbital notch is rounded and shallow, being 9 mm. wide and 3 mm. deep. From the centre of one notch to the centre of the other, as measured by callipers, is 49 mm.; the total width of the supraorbital torus is, as we have seen, 119 mm. wide. If we take the centre of the supraorbital notch as marking the junction of the supraciliary and supraorbital elements on the upper margin of the orbit, then the supraorbital elements form 70 mm. and the supraciliary 49 mm. of the total width of the torus; the supraorbital elements form 58.8 per cent. of the total width. Male aborigines of Australia represent the most primitive supraorbital condition among living races. Measurements made on ten skulls give the following means: the total supraorbital width is 112.6 mm., the supraciliary segment measures 57.2 mm., the supraorbital 55.4 mm., the supraorbital element being only 49 per cent. of the whole in place of almost 59 per cent. in the Galilee skull. We have here brought out one of the distinctive features of Neanderthal man—the enormous development of the supraorbital element of his bony eyebrow ridges. This contrast is also observed if we take the skulls of ten British males to represent the condition of these ridges in modern Europeans. In them the mean supraorbital width was 106.8 mm., the

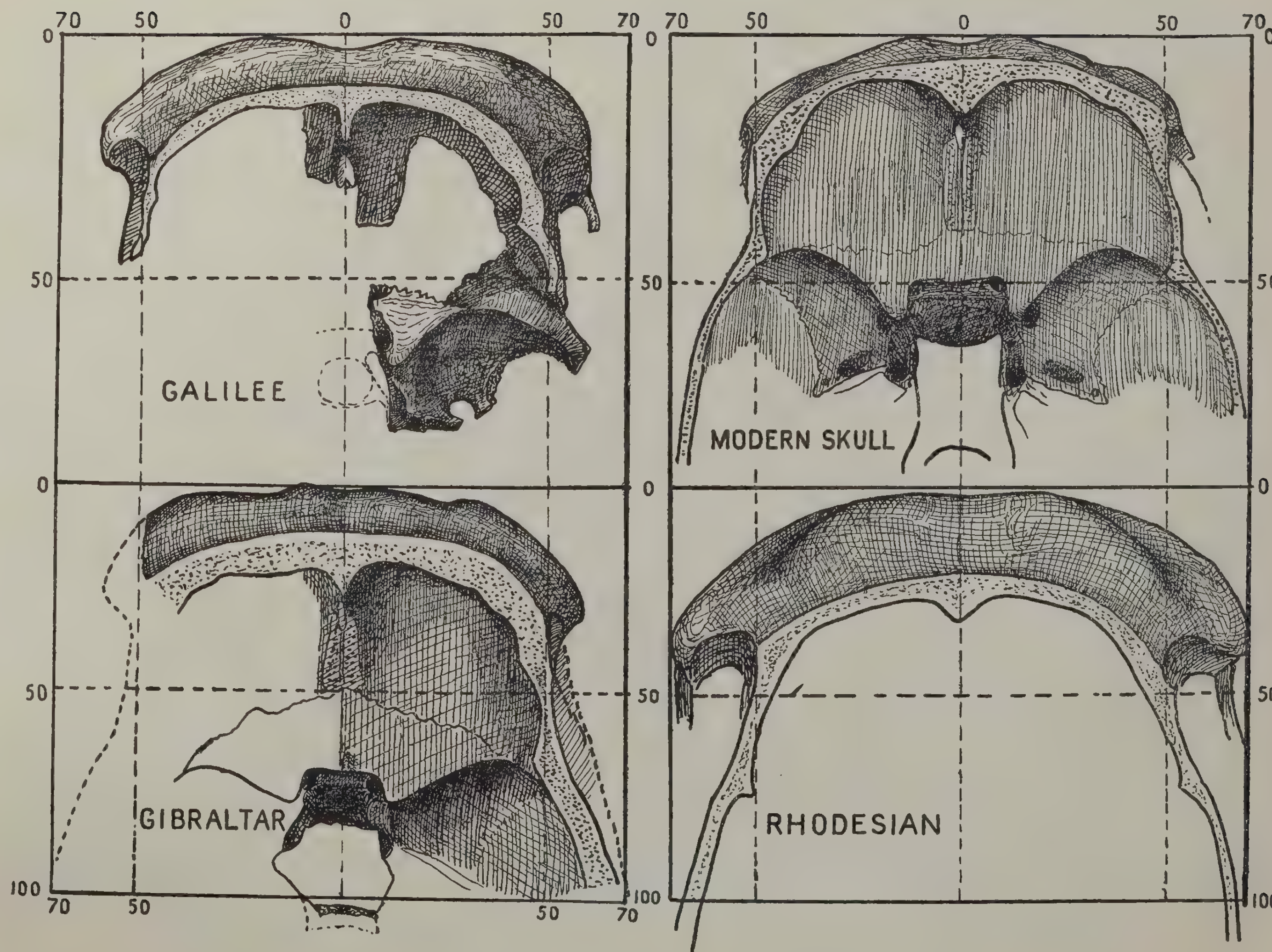


FIG. 15

Horizontal sections of the frontal region of various skulls made immediately above the supraorbital ridges, the skull being poised in the sub-cerebral plane. The numbers indicate millimetres. The skulls thus shown are the Galilean, the Gibraltar, modern English skull, and the Rhodesian skull.

supraciliary element measuring 48.8 mm., the supraorbital 58 mm., the latter being 54.3 per cent. of the whole.

The predominance of the supraorbital element of the torus is also brought out in another series of drawings reproduced in figs. 15 and 16. The method employed by the author makes it possible to reproduce sectional drawings of a skull if free access can be obtained to its cranial cavity—without actually cutting the specimen. In the drawings here reproduced sections of the forehead are made in a horizontal plane—just above the supraorbital torus—the skulls for the purpose of such drawings being poised in the sub-cerebral plane.

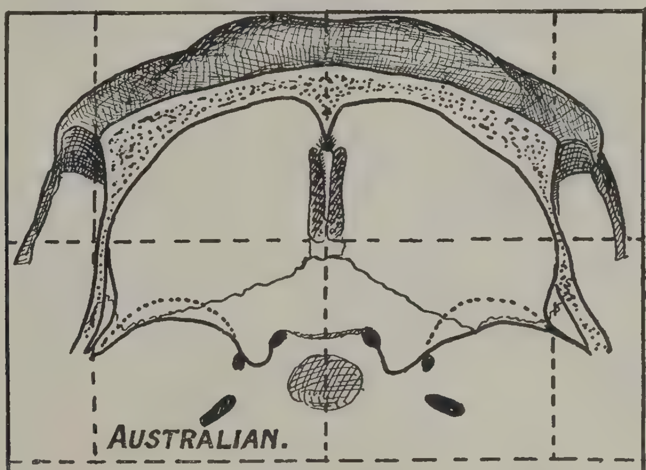


FIG. 16

A horizontal supraorbital section of the skull of a male Australian aborigine in which the supraorbital ridges were massively developed.

The drawings given in figs. 15 and 16, made to scale, and drawn originally natural size, give an accurate means of estimating the degree to which the elements of the supraorbital torus project beyond the true cranial wall—both in a forward and in a side to side direction. In fig. 15 will be noted the remarkable supraorbital development of the Rhodesian skull; nothing approaching such a supraorbital growth has been seen in any other form of human skull. The opposite condition is shown by a section of a modern British skull in which there was quite—for a modern European—a fair supraorbital development. In fig. 16 is given a corresponding section of a skull of an Australian male aborigine showing the most robust degree of supraorbital development to be found in modern races. Corresponding sections of two Neanderthal skulls—the Galilean and Gibraltar—are depicted in fig. 15. A com-

parison of these drawings will show how much the supraorbital predominates over the supraciliary element in the two Neanderthal skulls and in the Rhodesian specimen;

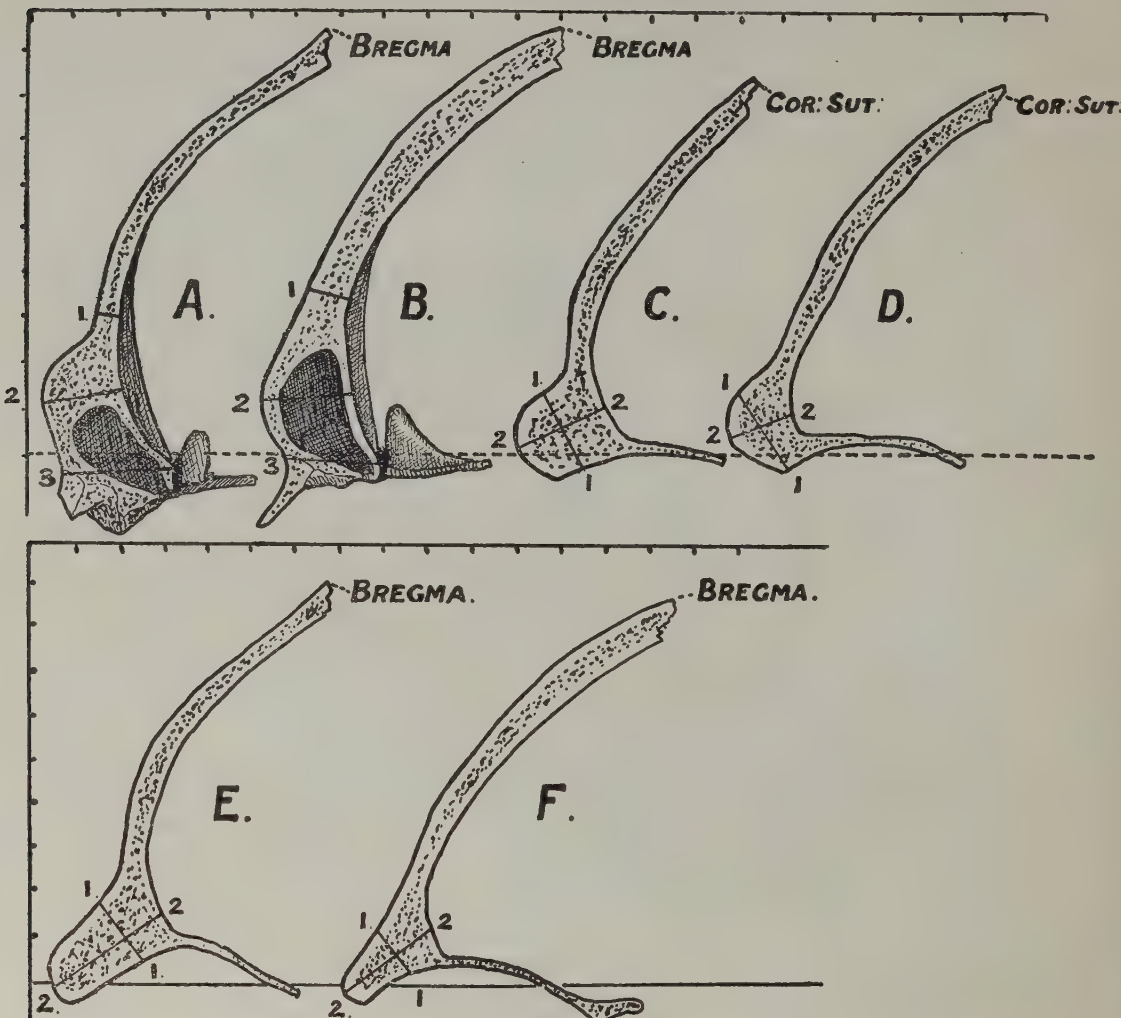


FIG. 17

A series of sections of the frontal bone to illustrate a method of measuring supraorbital development: A. Sagittal section of the Galilee frontal made immediately to the left of the mid plane: (1) Supraglabellar diameter of the bone; (2) the glabellar thickness; (3) the basal thickness or diameter. B. A corresponding section of the frontal bone of a male Australian aboriginal in which the supraorbital development was massive. C. Sagittal section of the Galilee frontal made 25 mm. from the mid plane. D. Corresponding section of the Australian frontal bone represented in fig. B. E. Section of the Galilee frontal made as described in the text. F. A corresponding section of the Australian frontal bone.

this element is seen to be particularly robust in the Galilean and Rhodesian skulls. Further, the diagrams show that if we are to make a reasonable comparison of skulls, as regards their length, we must distinguish between how much is due to glabellar thickness or projection and how much is made up of the length by the actual brain-containing wall of the skull. In the Galilean skull, if we are to compare its true length with that of modern Europeans, at least 10 mm. should be deducted on account of the glabellar projection.

There is great need of an accurate method of depicting and estimating the

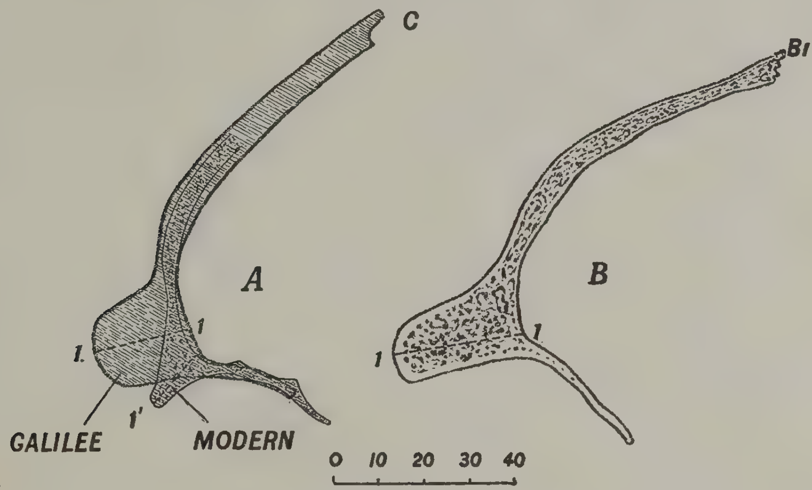


FIG. 18

A. Section of the Galilee frontal made in the sagittal plane, 25 mm. from the median plane of the skull. On it has been superimposed the drawing of a corresponding section made of a modern European frontal in which the supraorbital ridges were moderately developed. B. Section of the Galilee frontal made in an oblique vertical plane, one which lays open the supraorbital torus midway between the supraorbital notch and the outer extremity of the torus, and ends above at the bregma.

degree of supraorbital development. The method I have adopted is shown by the series of sections given in figs. 17 and 18.

The series commences with a section of the Galilee frontal (A) made immediately to the left of the median plane of the skull so that the internal frontal crest is seen. The total length of this crest is 40 mm., and its depth, at its middle part, is 9.5 mm. and although this crest is much more developed and stronger than in modern European skulls, yet it is of about the same size and strength as that of the frontal bone of a male Australian aborigine shown in the adjacent section (B). Just above the glabellar part of the torus the cranial wall of the frontal bone measures 5 mm. in

thickness (fig. 17, A, 1), and this is the prevailing thickness of the bone, although near the coronal suture the thickness increases to 7 mm., and the same thickness is attained over the region of the frontal eminences. The thickness of the frontal bone thus varies from 5 to 7 mm.—about the same amount as in La Quina skull and a little less than in Krapina C. In most Neanderthal skulls a thickness of 8 to 10 mm. is reached—particularly in the more massive skulls, which are almost certainly those of men. The thinness of the Galilee skull is another point which favours its female nature.

The manner in which I have measured the thickness of the supraorbital torus in the region of the glabella is shown in fig. 17, A, 2. Its thickness here is 18 mm.; the amount to which the glabellar thickness exceeds that of the supraglabellar wall is $18-5$ mm. $= 13$ mm. The glabellar projection is 13 mm. In fig. 17, B are given corresponding measurements of the frontal of a male Australian aborigine in whom the supraorbital ridges were massively developed, and in which the frontal bone was very thick, particularly near the sagittal plane of the skull. In this instance the frontal bone above the glabellar thickening measures 10 mm.; the glabellar thickening 21 mm.; on my system of estimating the projection of the glabella the amount is $21-11$ mm. $= 10$ mm., not much less than in the Galilee skull. The Australian forehead is the stouter built. Another measurement which I think is significant is what I would name the basal thickness of the frontal. It is measured from the foramen caecum to the nasion. The basal thickness in the Galilee frontal is 24 mm.; in the Australian skull, 21 mm. The corresponding measurements in the Gibraltar skull are 10 mm., 23 mm., 24 mm.; the glabellar projection, 13 mm.—the same as in the Galilee skull. In the Rhodesian skull the same measurements are 8.5 mm., 26 mm., 24 mm.; in this case the glabellar projection is 17.5 mm.—the greatest known in a human skull.

The second situation at which I make an estimate of the thickness of the supraorbital torus is in the midst of its supraciliary element. In fig. 17, C a sagittal section of the Galilee frontal is represented, made 25 mm. distant from the mid-sagittal plane. As indicated in the drawing two measurements are made: 1 1, its vertical thickness measured from the roof of the orbit to the upper surface of the torus; the other measurement, its anteroposterior thickness, is taken from the cerebral surface to the free convexity of the torus (fig. 17, C, 2 2). In the Galilee skull the vertical thickness measures 16.5 mm.; in the Gibraltar skull, 17 mm.; in Krapina C, 13.8 mm.; in the Rhodesian skull, 21 mm.; in Spy I, 16 mm.; in the Australian skull (fig. 17, D), 17 mm. The antero-posterior thickness of the supraciliary torus of the Galilee skull measured 21 mm.; of Krapina C, 22 mm.; in a male Australian (fig. 17, D, 2 2), 14 mm. It is not the vertical thickness, but the forward projection of the

superciliary region of the torus which constitutes the characteristic feature of Neanderthal man.

The manner in which an accurate estimate of the development of the outer or supraorbital part of the torus may be made is illustrated in fig. 17, E, F. In E a vertical section of the Galilee frontal is shown; it is made obliquely to the sagittal plane of the skull, commencing on the torus midway between the supraorbital notch and the outer extremity of the torus and terminating at the region of the bregma. The section of the torus so made is nearly at a right angle to the cerebral surface. The two measurements taken are indicated (fig. 17, E), 1 1, being a measurement of the vertical thickness of the torus, and 2 2, of its antero-posterior thickness. The vertical measurement is 12 mm., the same as in the Gibraltar skull and in the two Krapina examples. In Spy I this measurement is 13 mm., while in the Rhodesian skull it reaches the extreme degree of 18 mm. In the Australian skull, already mentioned (fig. 17, F) the vertical measurement is 9 mm. The antero-posterior thickness of the external part of the torus is 28 mm. in the Galilee skull and 23 mm. in the Australian skull used for comparison. These measurements serve to emphasize the great development of the supraorbital element in the frontal torus of Neanderthal man.

To show the degree to which the supraorbital development has been reduced in modern Europeans I have superimposed in fig. 18, A a section of a modern frontal bone on that of the Galilee skull. The sections there shown were made 25 mm. distant from the median sagittal plane of the skull. It will be seen that the supraorbital ridges of modern man have been reduced most in their vertical thickness, and that there has also been a downward thrust in the direction in which the supraorbital ridges develop. I intended to superimpose on fig. 18, B a corresponding section of a modern European frontal bone, made towards the outer end of the supraorbital ridge, but found it unnecessary, as the changes in that part of the ridge are similar to those shown in the supraciliary region.

Inclination and Curvatures of the Frontal Bone.

The length of the Galilee frontal bone, as measured by tape from nasion to bregma, is 125 mm.; the chord of the bone, measured by callipers from nasion to bregma, is 113 mm. The bregma is not preserved in the Gibraltar skull, but its position can be inferred. The frontal arc, in this skull, measures 124 mm.; its chord 115 mm. The length of the frontal arc varies in the known examples of Neanderthal skulls: in Spy I it is only 105 mm., in Spy II 120 mm., in La Chapelle 121 mm., in La Quina 124 mm. (?); in the original Neanderthal 133 mm. Thus as regards length of arc the Galilee frontal holds an intermediate position. The large glabellar develop-

ment of Neanderthal skulls increases the arc length of the frontal. In the Galilee skull the glabellar arc, measured from nasion to ophryon, is 30 mm., against 26 mm. in the Gibraltar skull. Owing to the difficulty of fixing the exact position of the ophryon, especially in modern skulls, this measurement is of no value for comparative purposes. For example, the male Australian skull, with the heavy supraorbital ridges, which I have cited in previous passages for purposes of comparison, and of which a sagittal section is reproduced in fig. 19, has a glabellar arc of 35 mm., but, as

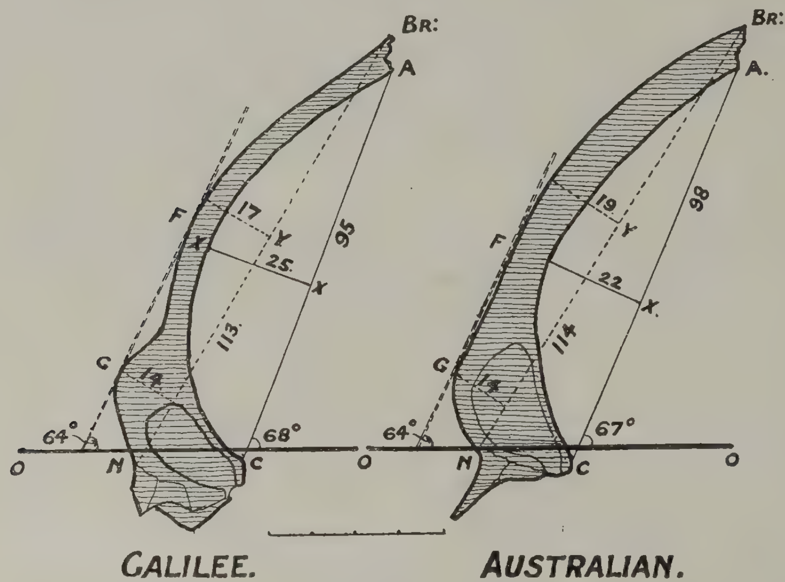


FIG. 19

A sagittal median section of the Galilee frontal bone oriented on the sub-cerebral plane, and compared with a corresponding section of the frontal bone of a male Australian aborigine in whom there was an extreme degree of supraorbital development. Further explanation will be found in the text.

may be seen from fig. 19, the glabellar arc of the Galilee skull has the distinctive Neanderthal form.

The study of the interior of the frontal bone is more likely to yield us information regarding the nature of extinct types of man than a record of the external characters. The interior of the frontal bone reveals the frontal characters of childhood; the exterior tells us of the changes which take place in adolescence and in full growth. The external arc of the Galilee frontal measured, as we have seen, 125 mm.; the internal arc, measured from the foramen caecum (fig. 19) to the internal bregma, parallel to the internal frontal crest, measured 110 mm. In the Australian frontal,

represented in fig. 19, the external arc measured 130 mm., the internal 110 mm., exactly the same as in the Galilee specimen. The greater thickness of the Australian bone accounts for the greater length of the Australian external frontal arc. There is nothing distinctive about these measurements; they may be found in skulls of any race. The Galilee frontal is the more curved of the two (fig. 19); in childhood the Galilean forehead was the more protuberant or bulging, although even the Australian forehead, during childhood, drew in as it descended to the nose. The manner in which the true curvature of the frontal bone should be estimated is shown in fig. 19. The internal frontal chord is drawn from the cranial orifice of the foramen caecum (C) to the internal bregma (A): in the Galilee frontal the chord measures 95 mm.; in the Australian frontal, 98 mm. The deepest part of the frontal curve is represented at X; it measures 25 mm. in the Galilee frontal; 22 mm. in the Australian. In the one case the depth of curve represents 26.3 per cent. of the chord, in the other 22.4 per cent. The index of the frontal curvature in the Galilee is 26.3, in the Australian 22.4. The form of the internal curvatures are seen in fig. 19 to be of a different character. The usual manner of estimating the external curvature of the frontal is shown in fig. 19. The frontal chord, taken from nasion to bregma, measures 113 mm. in the Galilee specimen, 114 mm. in the Australian; the greatest distance from the chord to the exterior of the bone lies at Y (fig. 19), and measures 17 mm. in the Galilee specimen, 19 mm. in the Australian, giving the latter the greater external curvature. And yet, as we have just seen, the Galilean bone is the more curved. The distance from the nasio-bregmatic chord to the glabella is the same in both cases, namely 14 mm.

As to the angle of inclination of the frontal we may employ either the internal chord of the frontal, its external chord, or a line joining the glabella to the most prominent part of the forehead above the glabella—represented in fig. 19, G, F. The angle which the latter makes with the sub-cerebral plane is 64°, both in the Galilee skull and in the Australian. In both instances the inclination of the forehead is of a degree which is common in all races of mankind. In the Gibraltar skull the angle of external inclination is 67°, Spy I 56°, Spy II 70°, Neanderthal 63°, La Chapelle 64°, Krapina C 59°, Rhodesian 61°. In modern European skulls an inclination of 75°-85° is common. The small frontal angle of Neanderthal skulls is due to a lowness of vault and a great glabellar development rather than to any radical alteration in the slope of the frontal bone.

Coronal Suture.

This is the first occasion on which it has been possible to examine the details of the coronal suture on a Neanderthal skull. Its characters are depicted by the camera

in Plates XVIII and XX and by pen in figs. 11 and 20. At the bregma the frontal measures 7 mm. in thickness; it is 7 mm. thick at the stephanion, while below the temporal lines it sinks to 5 mm. It will be seen from fig. 20 that the free surface of the coronal suture presents an outer "toothed" lamina which is 4 mm. in thickness,

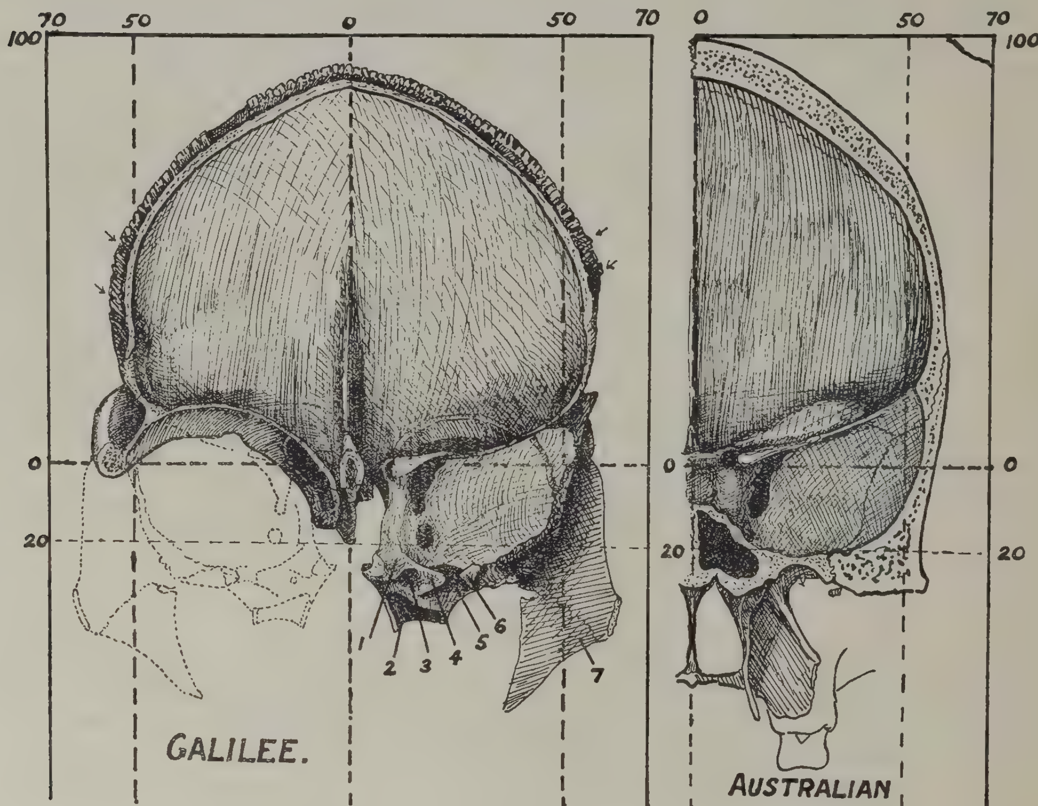


FIG. 20
Posterior view. Comparison of Galilee and Australian skulls.

and an inner smooth lamina which is 3 mm. in thickness. At the bregma the outer lamina overhangs the inner by 3 to 4 mm. Fifteen millimetres above the stephanion the inner lamina begins to project beyond the outer, and at the same time the outer lamina becomes serrated, the serrations having a depth of 5 mm. and extending down to the point where the lower temporal line crosses the suture. At the stephanion, and below it, the outer lamina of the parietal bone overlapped the inner lamina of the frontal by 9 mm. On the outer lamina of the frontal, above the region of the

parietal overlap, there are twenty-two little projections which must have dovetailed into corresponding sockets in the margin of the parietal bone.

The following measurements were made along the external border of the coronal suture. On the right side the arc from the bregma to the pterion measured 108 mm., 71 mm. lying above the stephanion—the point at which the lower temporal line crossed the coronal suture. The corresponding measurement on the left side was 100 mm., 69 mm. of which lay above the stephanion. As will be seen from fig. 20 there is a considerable degree of asymmetry.

We have seen that the maximum frontal width was 113 mm.; the corresponding internal width—which marks the transverse diameter of the brain in the region of the third or inferior frontal convolution—is 103 mm.—about 10 mm. less than is common in modern Europeans. Nevertheless, in the skull of an Australian male aborigine, which has been depicted in my previous illustrations and is again represented in fig. 20, the internal frontal width is exactly the same as in the Galilee frontal bone, and yet this Australian skull has a capacity of 1,400 cubic centimetres. In fig. 20 the height of the frontal compartment of the brain chamber is also represented—the height or distance of the internal bregma from the planum sphenoidale, taken just in front of the optic foramen. In both the Galilee and the Australian the vertical diameter of the frontal compartment, as estimated by the above method, is the same, 85 mm. And in another respect they are almost identical—in what may be called the depth of the frontal cup—the depth of the frontal bone measured from the plane of the coronal suture below the stephanion to the frontal pole (see fig. 22, x x). In both cases the depth of the frontal cup is almost the same—38 mm. in the Galilee skull, and 39 mm. in the Australian. Afterwards I shall deal with the surface markings of the frontal lobes of the brain, but these measurements suffice to show that the Galilean individual—probably a woman—had as large a development in the frontal lobes of the brain as the living Australian male aborigine. In the actual depth and size of the temporal lobe of the brain, as may be seen from fig. 20, the Galilee skull is the larger.

Basi-Cranial Axis.

By great good fortune the preservation of a large part of the right half of the sphenoid and the perfect state of the wide sutural surfaces by which the sphenoid is fitted to the frontal, it has been possible to reconstruct the main features of the basi-cranial axis as depicted in fig. 21. Thirteen years ago my friend Professor G. L. Sera drew attention to the remarkable and primitive form of the basi-cranial axis of the Gibraltar skull, a section of which is represented in fig. 21, below a corresponding drawing of the Galilee skull. There are four elements included in the

basi-cranial axis—the basi-occipital, the basi-sphenoid, the pre-sphenoid, and ethmoid. Two of these elements for the purposes of comparison we may regard

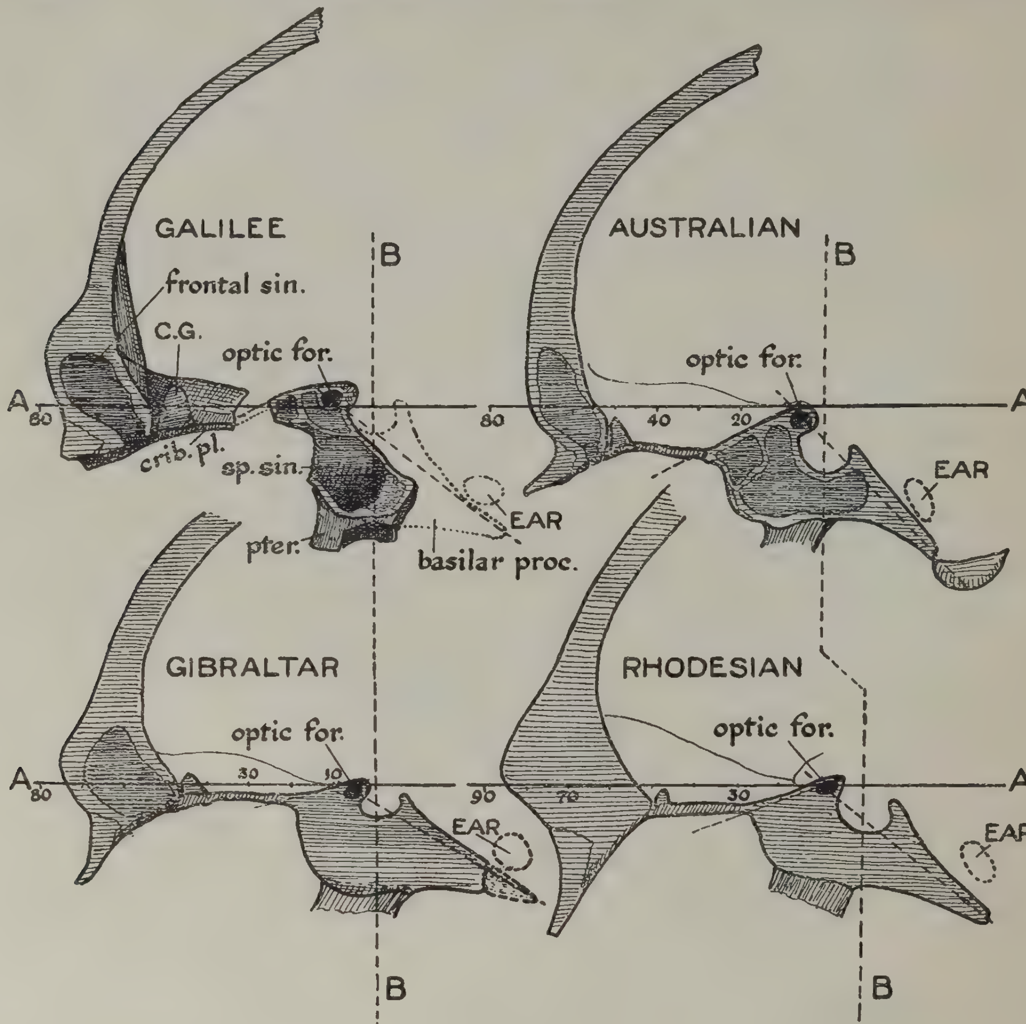


Fig. 21

Sagittal sections of the basilar parts of four skulls: Galilee, Gibraltar, Australian (male), Rhodesian. Each section is oriented on the sub-cerebral plane (A A); all have been drawn natural size. For purposes of comparison a vertical axis has been drawn through the middle of the pituitary fossa—the pituitary vertical axis. The prepituitary part of the base of the Rhodesian skull is longer than the others, and hence it has been found necessary to deflect the pituitary axis backwards in comparing the Rhodesian to the Australian. The missing part of the base of the Galilee skull is suggested by stippled lines. The Australian skull was chosen for illustration because of the peculiar angle shown in the pre-sphenoid part of its base.

as one—the basi-occipital and basi-sphenoid; we may indicate the plane of this part of the basi-cranial axis by drawing a line from the basion to a point lying midway between the centres of the optic foramina (see stippled line in fig. 21). The plane of the pre-sphenoid part of the axis may be indicated by a line joining the upper margin of the optic foramen to one which marks the junction of the pre-sphenoid with the ethmoid. The cribriform plate indicates the plane of the ethmoidal part of the basi-cranial axis. As will be seen from fig. 21 the olfactory plates are almost parallel to the sub-cerebral plane in the Gibraltar and Rhodesian skulls, and this is also almost the case as regards their pre-sphenoidal parts of the axis. These two parts—olfactory and pre-sphenoid—of the Rhodesian and Gibraltar skulls, form almost a direct line, although in the case of the Rhodesian skull the pre-sphenoid element has a certain degree (16°) of deflection from the sub-cerebral plane as it passes forward. In the Australian skull there is a marked downward dip of the pre-sphenoid; the angle it makes with the sub-cerebral plane is 28°. From the arrangement of parts in fig. 21 it will be seen that there must have been a dip of a similar nature in the Galilee skull, the angle being about 24°. The condition seen in the Gibraltar and Rhodesian skulls is that which is present in the skulls of the higher anthropoids, and we must presume is the form to be found in the skulls of the most primitive types of mankind. In the Galilee skull we have, in its pre-sphenoidal angle, a more recently acquired condition.

The more primitive the skull the longer is the post-optical part of the basi-cranial axis and the less is the angle that this part of the base makes with the sub-cerebral plane. Such a primitive state is seen in the Gibraltar skull; the distance from the mid-optic point to the basion is 51 mm., and the angle which this line makes with the sub-cerebral plane is 32°. These two measurements in the Galilee skull, as estimated by postulating the missing parts as shown in fig. 21, may be given as 52 mm., 38°; in the Rhodesian skull the corresponding figures are 49 mm., 40°; in the Australian skull 45 mm., 45°. The angle between the pre-sphenoid and post-optical element of the base, which represents the degree of bending or flexion of the basi-cranial axis is, in the Gibraltar skull, 137°, in the Galilee skull 118°, in the Rhodesian skull 124°, in the Australian skull 107°. The more the flexure of the basi-cranial axis, the more has a foetal character been preserved and the higher is such a skull to be counted in the scale of evolution. In this respect the Galilee skull stands intermediate to the primitive condition seen in the Gibraltar skull and the more evolved condition seen in the Australian skull. As reconstructed in fig. 21, the length of the basi-cranial axis, the distance between nasion and basion, is 108 mm., almost the same as in the Gibraltar and Rhodesian skulls, but 14 mm. more than in the Australian skull used for comparison. The distance from the mid-optic point to the nasion is 64 mm. in both Gibraltar and Galilee skulls; in the Rhodesian the

distance is 3 mm. more, in the Australian 5 mm. less, the diminution in the latter case being due to a retraction of the region of the nasion.

Sphenoidal Air Sinus.

On the body of the sphenoid, as may be seen in fig. 21, certain peculiar features of the sphenoidal sinus can be made out in the Galilee skull. The sinus, which was clearly of extensive dimensions, extended into and inflated the pterygoid process (see fig. 23)—a condition which always occurs in the skulls of adult anthropoid apes but is rarely seen in the skulls of modern human races. The sinus extended into the pre-sphenoid in front of the optic foramen, an imperfect septum (fig. 21) separating this part of the sinus from the main body. The extension of the sphenoidal sinus into the pterygoid process is probably of constant occurrence in Neanderthal skulls. Such an extension is present in the Gibraltar skull.

The Retro-orbital Region of the Temporal Fossa.

In fig. 22 a characteristic difference is brought out between the Neanderthal and Neanthropic types of skull. The skull of a male Australian aborigine, which I have employed for the purposes of comparison in various parts of this paper, is depicted in fig. 22 to represent the condition seen in neanthropic or modern man. The temporal bone has been removed to expose certain parts which are shaded in fig. 22—the optic foramen (1), the anterior clinoid process of the orbito-sphenoid (2), and the anterior part of the fossa for the temporal lobe of the brain (3). The same view is given of the Galilee skull, but it will be observed that much less of the orbito-sphenoid is exposed in this case. In the Australian skull the free extremity of the anterior clinoid process projects 18 mm. behind the free edge of the alisphenoid —behind the spheno-squamous suture—while in the Galilee skull only 8 mm. are exposed. We have here a characteristic difference between the Neanthropic and Neanderthal types of man. The difference is due to the preponderance of the squamous plate of the temporal in neanthropic man; it pushes forward the great wing of the sphenoid and compresses it in an anteroposterior diameter. The great wing is wider in Neanderthal man; measured along the line marked Y Y in fig. 22, the sphenoid has a width of 21.5 mm. in the Galilee skull, 23.5 mm. in Krapina C, 20 mm. in the Gibraltar skull, and only 13.5 mm. in the Australian skull. On the other hand, the great wing reaches upwards, at its hinder angle, much higher on the side of the skull—5 to 10 mm.—in the neanthropic type than in the Neanderthal type. We have, as may be seen in fig. 22, a characteristic difference in the form assumed by the great wing in the Neanderthal and neanthropic types, and a com-

parison with other skulls shows that the form seen in the Galilee skull is that which occurs in Neanderthal skulls, but never in skulls of living races of mankind.

One other point is brought out in fig. 22, the depth of the orbital plate of the malar bone in the Galilee skull—also a Neanderthal characteristic. From the

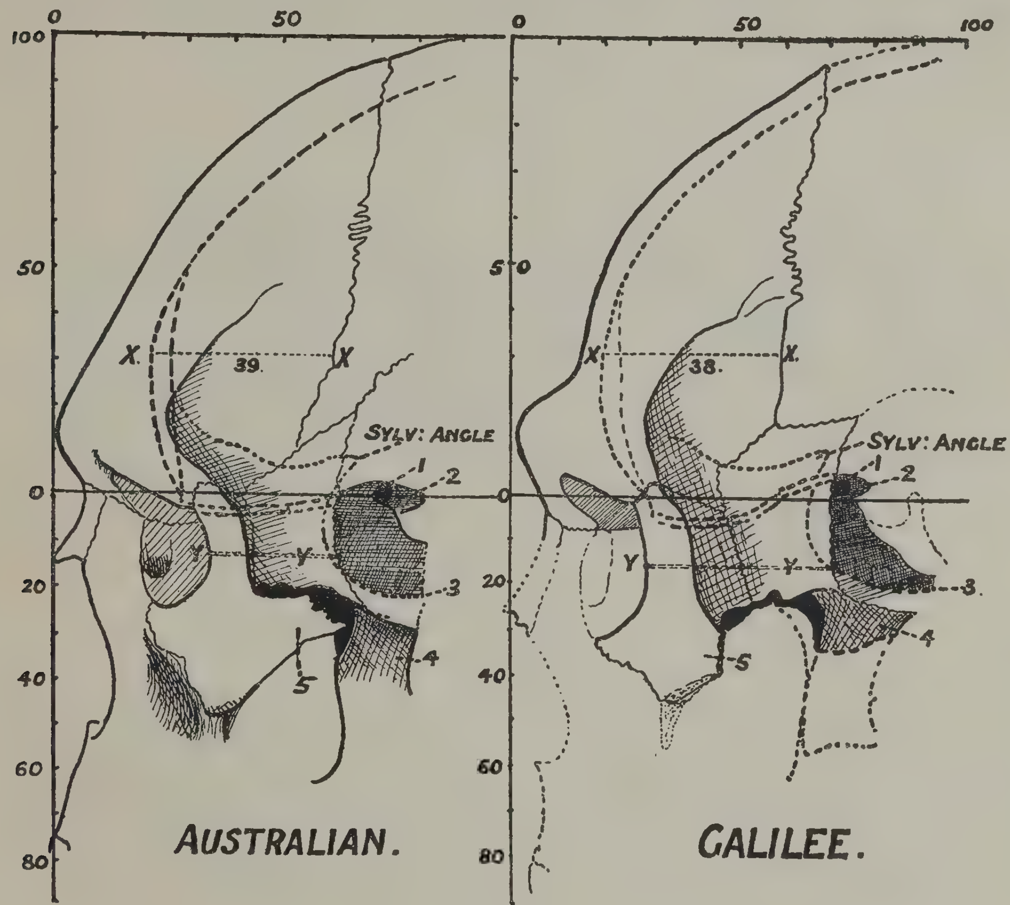


FIG. 22

The retro-orbital region of the temporal fossa: (1) in the skull of an Australian aborigine of a primitive type; (2) in the Galilee skull. Both drawn in true profile, natural size. The inner surface of the frontal bone is indicated by a broken line, the floor of the anterior fossa by a double broken line. The floors for the inferior frontal convolution and for the temporal pole of the temporal lobe are indicated by a stippled line; these meet at the *sylvian angle*, represented in the skull by the outer part of free edge of the anterior fossa of the skull. (1) optic foramen; (2) anterior clinoid process of the orbito-sphenoid; (3) floor of the middle fossa for temporal lobe of brain; (4) root of pterygoid process; (5) the zygomatic process of malar; x x, method of measuring the cerebral depth of the frontal cap.

orbital margin of the malar bone, measured by callipers at the site indicated in fig. 22, Y Y, to the malo-sphenoid suture, amounts to 13.5 mm. in the Australian skull, 20 mm. in the Galilee skull, 18 mm. in the Gibraltar skull, and 20 mm. in the Rhodesian skull. I shall return to other features of the malar bone in describing the orbit. In the meantime I may draw attention to the fact that the cribriform plate, the floor for the inferior convolution of the frontal lobe, and the pole of the temporal lobe hold almost similar relationships to the superficial parts of the skull in both the specimens represented in fig. 22.

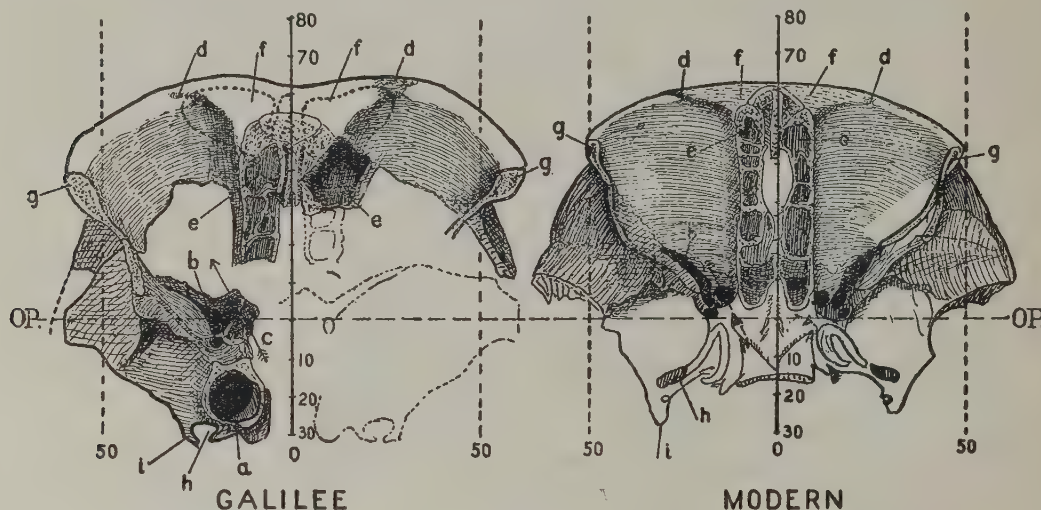


FIG. 23

The under aspect of the Galilee cranial fragment drawn on a plane which passed from the region of the nasion to the under surface of the body of the sphenoid bone. For the purposes of comparison a similar drawing has been made of the skull of a British male, in whom the supraorbital development was slight. Both specimens have been set on a transverse axis OP-OP, which crosses the optic foramina. The lateral vertical stippled lines are 50 mm. from the mid-plane. *a*, sphenoidal air sinus passing into the root of the pterygoid process; *b*, sphenoidal fissure opening into orbit; *c*, the arrow passes through the canal for optic nerve; *d*, supraorbital notch separating supraciliary from supraorbital elements; *e e*, frontal air sinuses; *g*, malar process of frontal at fronto-malar suture; *h*, foramen ovale; *i*, spine of alisphenoid.

The Orbital Region and Air Sinuses.

In fig. 23 the under aspect of the Galilee cranial fragment is represented, and by it is placed a corresponding drawing of a British skull in which the supraorbital ridges were weakly developed, as is so often the case in modern city dwellers. In both cases the roof and side walls of the orbit are represented. The contrast between the supraorbital development of the two specimens is marked; the width in the one

case is 119 mm., in the other 100 mm., and it will be again seen that it is the supraorbital element which suffers the greater reduction in the modern skull. The orbit is deep in the Neanderthal type of skull, due chiefly to the great supraorbital development; in life the eyeball of the Galilean individual must have had the appearance of being deeply set within the orbit.

The frontal air sinuses of the Galilean skull are less extensive than is often to be seen in the skulls of modern Europeans. In fig. 17 the frontal sinus is exposed in sagittal section; it does not reach upwards much more than half the height of the supraorbital torus. The width of each sinus is shown in fig. 23; they extend outwards as far as the supraorbital notch. On the left side (fig. 23) it will be seen that part of the roof of the orbit and the adjoining part of the internal angular process—the nasal process of the frontal—have been broken away showing that the frontal sinus extends over the inner part of the orbital roof. The sinus of the right side is divided into two compartments, the mesial being much the smaller. Both compartments open into a wide infundibulum which occupies the position of the anterior ethmoidal, all being bounded in front by the nasal process of the maxilla, and, when the skull was intact, inflated the deep or ethmoidal surface of the lachrymal bone. Behind the infundibulum follow two (middle ethmoidal) cells placed side by side; behind these cells come part of another, apparently the posterior ethmoidal. The root of the pterygoid process is seen to be inflated by an extension of the sphenoidal sinus.

The orbit is deep, its depth was measured from the posterior border of the optic foramen within the orbit to the following points: to the mid-point of the upper margin of the orbit to represent depth of roof, 62 mm.; the same measurement is 63 mm. in the Gibraltar skull, 65 mm. in the La Chapelle and Rhodesian skulls, while in the massive Australian specimen used for comparison this measurement was 60 mm. The internal wall was measured to the site of the dacryon; it was 49 mm., the same as in the Gibraltar skull, 2mm. more than in the Rhodesian, and 5 mm. more than in the Australian specimen. The external wall, measured to the mid-point of the lateral border of the orbit, was 55 mm., the same as in the Gibraltar skull, 2 mm. more than in the Rhodesian and 5 mm. more than in the Australian skull. The floor, measured from the optic foramen to the mid-point of the lower orbital border, had a depth of 55 mm., the Gibraltar 56 mm., the Rhodesian skull 54 mm., the Australian the same. The width of the orbit, taken from the site of the dacryon to the mid-point of the lateral margin of the orbit, measured 40 mm.; its height, 37 mm. The orbit of the Gibraltar skull has a width of 45 mm. and a height of 41 mm.; we shall see that the greater orbital width in the latter specimen is due to the oblique plane in which the outlet of the orbit is set. The height and width of

the orbit in Krapina C are almost identical to those of the Galilee skull; the skulls in both instances are probably those of women.

Interorbital Septum.

In fig. 23 there is exposed a horizontal section of the septum which separates one orbit from another; it is seen to be of much greater width than that of the modern skull used for comparison. Its width is uniform from the entrance behind the optic foramina to the site of the dacryon in front, being 28 mm. The interorbital or interangular diameter in the Gibraltar skull is 24 mm., in Krapina D 28 mm., in Krapina C 29 mm., in Spy I 32 mm., in the Rhodesian skull 35 mm., in the Australian skull here used for comparison 27 mm. It will be seen that the interorbital width in the Galilee skull is moderate. When we compare the interorbital width with that of the total orbital width, measured with callipers from one lateral margin to the other, we find the following result. The biorbital width is 109 mm.; the interorbital being 28 mm., the latter representing 25.5 per cent. of the biorbital width. The biorbital width of the Gibraltar skull is only 102 mm., the interorbital percentage being 23.5. In the La Chapelle skull the biorbital width is 112 mm., the interorbital percentage 26.8. The corresponding figures for the Rhodesian skull are 119 mm., 29.4 per cent.; for the Australian specimen 108 mm., 25 per cent. Thus the Neanderthal skulls have wide interorbital septa and wide orbits, but there is an extensive field of overlap between the higher members of the Neanthropic group and the lower members of the Neanderthal group. Rhodesian man overtops the highest Neanderthal measurements.

Nasal Bones and Nose.

As may be seen from figs. 11, 12, and 14, there remains attached to the interorbital septum fragments of the root of the nose. Enough remains to show that the nose had the wide flat arch which occurs in Neanderthal man and which is reminiscent of the nasal bridge found in the gorilla. The feature which first impresses the observer about the fragment of the nasal bones which remain in the Galilee specimen is the disappearance of the suture between them; although a young adult the nasal bones of the Galilee individual have already fused—an event which occurs early in the childhood of the great anthropoid apes. The section of the nasal bones and frontal process (fig. 23) shows how thick and strong the nasal bones and nasal process of the maxilla were. The parts of the nasal bones which were present had a length of 9 mm. measured along the mesial suture; their width as measured by callipers at the junction of the frontal, where a nearly transverse sutural line is formed, is 14 mm.; a little lower down the nasal width is 13 mm.; still farther down, a distance

of 8 mm. from the naso-frontal junction, where the fracture has taken place, the width is 15 mm. The nasal bones are but slightly convex from side to side, the height of the convexity rising 3.5 mm. above the chord which joins one lateral nasal margin with another. The right nasal process of the maxilla, of which 11 mm. of length is preserved, is almost square in transverse section, being 5 mm. wide. Thus, just below the nasion the width of the bridge of the nose from the lateral margin of the nasal process to the corresponding point on the opposite side was 23 mm., this being apparently the distance of the inner margin of one lachrymal fossa from the corresponding margin of the other. There is no need here to give the dimensions of the nasal bones in the Gibraltar and Krapina skulls—the only known examples in which the nasal bones are preserved; it is enough to say that the Galilee individual had apparently the same wide flat saddle-backed nose as is to be seen in these examples. This was also the case in the Rhodesian skull. The narrow high nose is a feature which has been acquired late in the evolution of man.

Form of Face.

In the discrimination of living races one obtains much assistance from the modelling of the face—particularly in the degree to which the nose and other parts of the median line project in front of the cheeks and other structures on the lateral aspects of the face. Races tend to be flat-faced in the region of the orbits, or wedge-faced. The flattening in some cases, as in Mongolian races, is due to a retrocession or sinking in of the nose or median parts of the face; in other races it is due to an advancement of the cheek bones and lateral walls of the orbit. The method I have adopted in recent years for measuring the degree of projection of the middle parts of the facial skeleton beyond the lateral parts is illustrated in fig. 24. The facial parts there shown are oriented on the Frankfort plane, which, although unsuited for investigations made on the cranial chamber, is eminently useful for investigations made on the face—an entirely separate piece of cranial machinery.

A glance at fig. 24 will show the reader that the transverse axis of the orbit varies greatly in obliquity; in the Gibraltar skull, for instance, and also in the La Chapelle and Rhodesian skulls, much of the inner wall of the orbit is seen in true profile, whereas in the Krapina and Australian skulls much less of the inner wall is seen either because the lateral wall of the orbit is more advanced in position or because the root of the nose and lachrymal region occupy a more backward position. For the discrimination of races these relationships have to be measured and compared. I use the upper meatal point—the highest point of the outer meatus of the ear on the Frankfort plane—as a zero point from which to measure the forward projection of the lateral wall of the orbit, the point selected being the mid-point of its lateral margin,

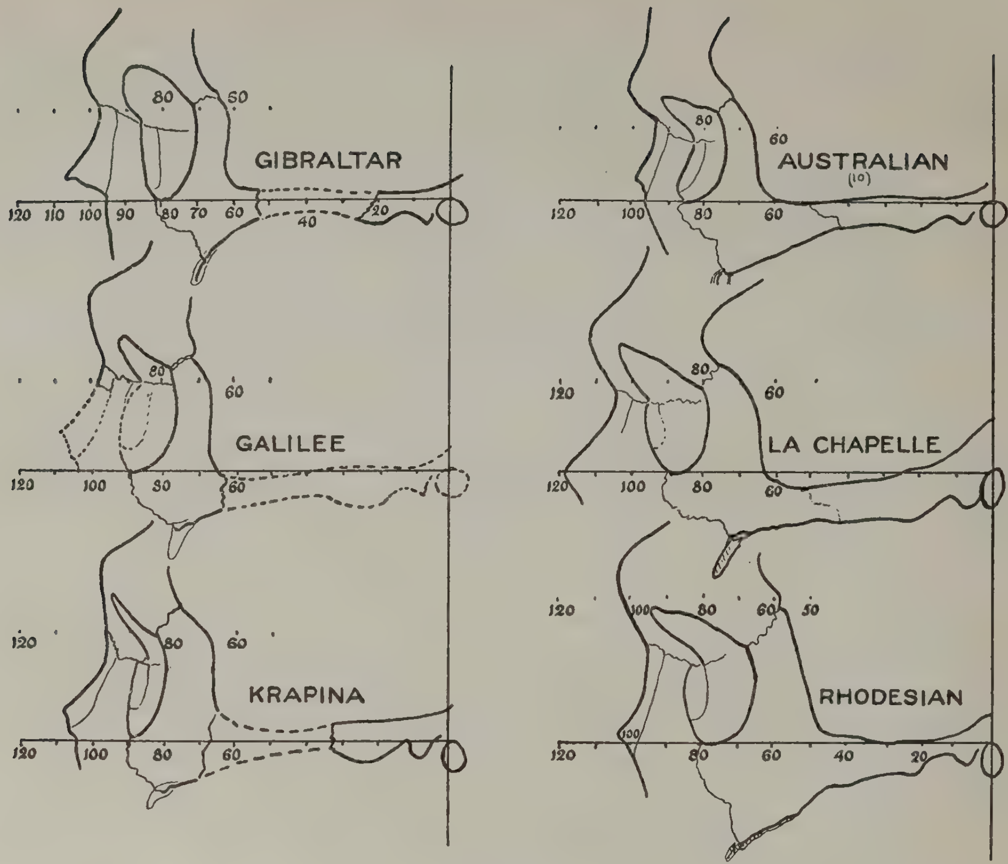


FIG. 24

To illustrate a method of measuring the flatness or sharpness of facial features. The parts are oriented on the Frankfort plane, the plane of the upper meatal point being taken as zero for measuring the forward projection of facial parts. The figures on the drawings indicate millimetres. Further explanation in the text.

TABLE OF PROJECTIONS OF SKULLS SHOWN IN FIG. 24

A. Distance of the lateral orbital point from the upper meatal point on the Frankfort plane.
B. Distance of the dacryon from upper meatal point measured along the Frankfort plane.
C. Projection of dacryon in front of lateral orbital point.
D. Projection of nasion in front of upper meatal point, measured along the Frankfort plane.
E. Projection of nasion in front of the lateral orbital point.
F. Projection of nasion in front of dacryon.

(The measurements for the Galilee skull are given from the hypothetical drawing reproduced in fig. 24.)

	A	B	C	D	E	F
Gibraltar skull . . .	70 mm.	85 mm.	15 mm.	98 mm.	28 mm.	13 mm.
Galilee skull	74 mm.	85 mm.	11 mm.	96 mm.	22 mm.	11 mm.
Krapina C	78 mm.	86 mm.	8 mm.	95 mm.	17 mm.	9 mm.
Australian skull . . .	74 mm.	83 mm.	9 mm.	94 mm.	20 mm.	11 mm.
La Chapelle skull . .	79 mm.	96 mm.	17 mm.	105 mm.	26 mm.	9 mm.
Rhodesian skull . .	65 mm.	84 mm.	19 mm.	95 mm.	30 mm.	11 mm.

the forward projection of the vertical ridge of the lachrymal bone or a point on the internal angular process corresponding to this ridge—the forward projection of the nasion. The forward projection of each point is measured by dropping a vertical from it to the Frankfort plane. The measurements are reckoned on this plane. The actual measurements for the six skulls shown in fig. 24 are given in the adjacent table, those for the Galilee skull being calculated from the estimated position of the auditory meatus. The face of the Krapina skull as represented in fig. 24 is remarkably flat; the lateral wall of the orbit is only 8 mm. behind the dacryon, whereas in the Gibraltar skull the corresponding measurement is 15 mm. I suspect that the drawing of the profile which Professor Kramberger has reproduced of the Krapina skull was traced from a photograph. In all profile photographs of skulls there is a high degree of distortion: near points, such as the lateral wall of the orbit, are exaggerated in their relationship to more distant points, such as the inner wall of the orbit. Nevertheless, in the Australian skull the dacryon is only 9 mm. in advance of the lateral orbital point, and in the skulls of Mongolian races the projection of the dacryon sinks to a lower figure. The La Chapelle skull has its orbits set obliquely; the dacryon is 17 mm. in advance of the lateral orbital point, while in the Rhodesian skull the obliquity is still greater—the dacryon being 19 mm. in advance of the lateral orbital point. In the Galilee skull the projection of the dacryon to the lateral margin of the orbit can be fixed with precision—it is 11 mm.; the individual falls into the flat-faced group when compared with the Gibraltar and La Chapelle skulls. It appears to agree in this respect with the Krapina skull. It will be seen from the accompanying table that the lateral wall of the orbit is situated far back in the Rhodesian and Gibraltar skulls and far forwards in the La Chapelle skull. The Galilee skull—if the position of the meatus has been rightly fixed—has the same degree of lateral orbital advancement as in the Australian skull here chosen as an exemplar of primitive neanthropic man.

The projection of the nasion in front of the lateral orbital wall is also an indication of sharpness or flatness of face. In the Rhodesian skull the projection of the nasion is 30 mm., in La Chapelle 26 mm., in the Gibraltar skull 28 mm., whereas in the Galilee skull it sinks to 22 mm.—another indication of the flatness of the Galilean face.

The projection of the nasion in front of the dacryon gives an indication of the depth or prominence of nasal development. The greater the projection of the nasion, the more prominent will be the roof and bridge of the nose. As may be seen from the accompanying table (column F) the depth of the nose does not vary much in the early or more primitive types of skull. The nasal projection is greatest in the Gibraltar skull (13 mm.) and least in Krapina C and La Chapelle (9 mm.). In this respect the Galilean nose occupies an intermediate position.

The sharpness or bluntness of the orbital region of the face can also be measured by the naso-orbital angle. The angle is formed by two lines which are drawn from the lateral orbital point and meet at the nasion. The narrower the face, and the more the nasion projects in front of the side walls of the orbit, the smaller is the naso-orbital angle. In the Galilee skull it measures 159°, in the Gibraltar skull it is only 134°. Professor Boule measured it in La Chapelle skull; it was 140°. We again see that the Galilee skull is flatter in the face than these two representatives of the Neanderthal skulls of Europe. Professor Boule gives the corresponding angle for the gorilla as 160°, almost the same as in the Galilee skull. If we merely measure the naso-orbital angle we obtain no information as to what has happened—whether the change has been in the nasal region or lateral orbital, whereas the method of projection elicits this information.

The Zygomatic or Malar Bone.

Professor Boule has drawn attention to the fact that the malar bone of Neanderthal man differs profoundly in shape and size from that of modern neanthropic man. In the former, the malar is small and sunken, merging into the inflated body of the maxilla just as it does in the skulls of anthropoid apes. The lower or masseteric border of the malar of modern man is supported from the body of the maxilla by a well defined buttress of bone—the malar process, which springs outward between the canine fossa in front and the zygomatic surface behind. In Neanderthal man the maxilla has no malar buttress; the masseteric impression on the lower margin of the malar passes directly on to the outer wall of the maxillary body. In all respects the malar bone of the Galilee skull is of the true Neanderthal type.

In fig. 25 a drawing is given of the outer aspect of the Galilee malar, and in B a similar drawing of the malar of a modern European. Both bones were oriented on a line F F, which passes from the upper border of the zygomatic or temporal process to the lower extremity of the orbital border. It will be observed that the orbital part of the Galilee malar, which lies above the plane of orientation, is massive and strong, whereas the infraorbital part, below the plane, is relatively small; exactly the opposite is the case in the modern malar. In both bones a vertical line has been drawn from *b*, the orbital extremity of the fronto-malar suture, to *e*, the lower end of the malo-maxillary suture; this vertical line divides the infraorbital portion of the bone into an anterior or maxillary part and a posterior or masseteric part. The real difference lies in the size of the masseteric part; it is by far the larger in the modern bone; the maxillary part is larger in the Neanderthal bone.

The Galilee malar is complete, all save in its temporal process, part of which has been broken away. The vertical diameter of this process measures 11.5 mm.;

in the modern malar 12 mm. In the Galilee malar the distance from the orbital end of the fronto-malar suture, *b*, to the farthest point of the orbital margin, *f*, is 33 mm.

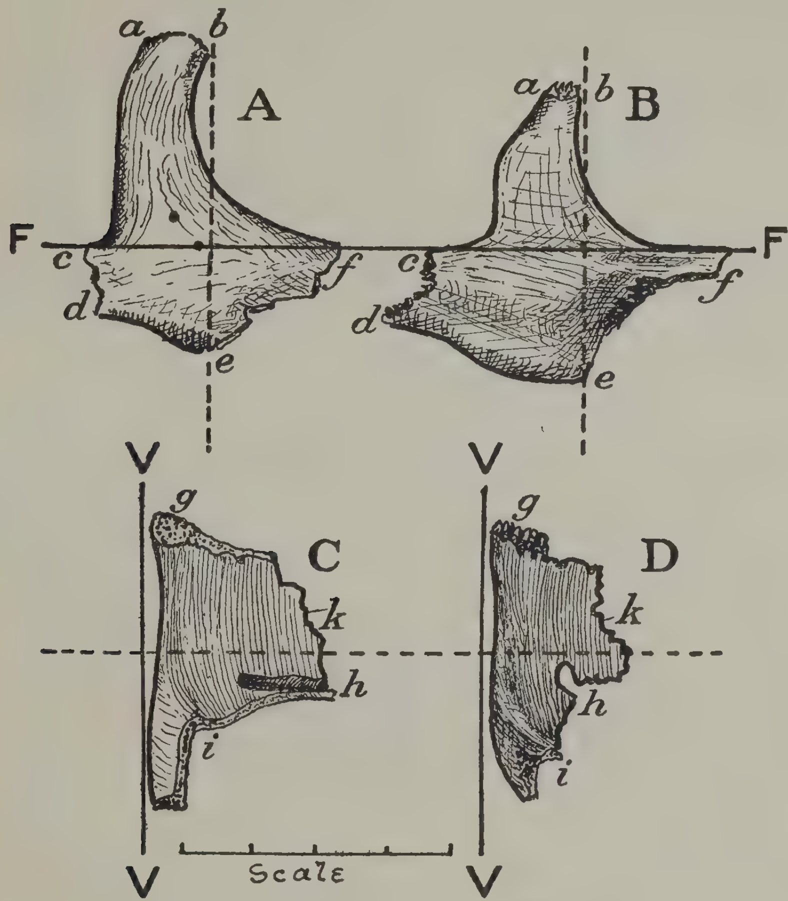


FIG. 25

A. The outer surface of the Galilee malar. The bone is oriented on a plane (F F) passing through the terminal point of its lower orbital margin in front and along the upper border of its temporal or zygomatic process behind. *a*, *b*, fronto-malar suture; *c*, *d*, broken end of temporal process; *e*, *f*, malo-maxilla suture. B. Similar drawing of the malar of a modern European. C. The orbital surface of the malar of the Galilee skull; *g*, fronto-malar sutural surface; *k*, spheno-malar suture; *h*, spheno-maxillary fissure; *i*, orbital margin. D. Corresponding drawing of malar bone of a modern European.

measured by callipers; measured along the curve of the margin, 38 mm.; the deepest point of the curve is 9 mm. from the chord (see fig. 25). The corresponding amounts in the modern bone are 32 mm., 37 mm., 10 mm. The length of the malo-

maxillary suture, measured by callipers from orbital to masseteric extremities, is 28 mm. in the Galilee specimen and 29 mm. in the modern. The lower or masseteric border is present to the extent of 14 mm. in the Galilee bone. The orbital process near its mid-point measures from orbital to temporal border 14 mm. (15 mm. in Krapina C, 11 mm. in the Gibraltar skull). It will be noticed that the temporal border of the Galilee malar describes an even curve; it has no tubercle or elevation as in the modern bone. As will be seen by comparing C and D in fig. 25, the orbital margin is more sharply marked on the ascending process of the Galilee malar than on that of the modern bone. The orbital plate of the malar, measured from orbital margin to the inner margin of the spheno-malar suture, is 23 mm.; in the modern bone 16 mm. The orbital plate makes an angle of 119° with the outer surface of the ascending process in the Galilee malar; the corresponding angle of the malar bone of an Australian male was found to be 105°.

Characters of the Neanderthal Sphenoid.

The Galilee sphenoid exhibits characters which are not seen in the corresponding bone of modern man. This is the first time that anyone has had an opportunity of examining these characteristics in detail—although even in this case the body of the bone is incomplete. Various aspects of the sphenoid have been already represented —surfaces which appear in the temporal fossa are shown in figs. 11 and 13; its body, as seen in a sagittal section in the median plane of the skull, in fig. 11; its surfaces which appear in the floor of the skull, in fig. 15; its posterior aspect in fig. 20. In fig. 26 a comparison is made between the Galilee sphenoid and that removed from the floor of the skull of a modern European—a male with a cranial capacity of 1,500 cubic centimetres. Both bones have been oriented on the plane of the upper surface of the lesser wings of the sphenoid—the orbito-sphenoid. The chief differences between the ancient and modern bones are seen along the hinder border of the great wing. This border, measured in a straight line from the inner border of the carotid groove to the angle or spine, is only 22 mm. in the Galilee bone, 36 mm. in the modern one. The direction of this border in the two specimens is different; it is nearly transverse in the ancient bone with a slight bend forwards, whereas in the modern specimen it tends backwards as well as outward. We have already seen (p. 80) how the expansion of the temporal squama in skulls of the modern type has pushed forwards the great wing of the sphenoid; the squama has equally invaded the floor of the middle fossa, compressing the middle part of the great wing inwards, rendering its outer border more concave than is the case in Neanderthal skulls.

Along the posterior or petrous border of the great wing of the Galilee sphenoid are to be seen from within outwards: (1) the carotid groove, only 5 mm. in width

compared with 7 mm. in the modern specimen; (2) the passage for the third division of the trigeminal nerve; a stout process (see figs. 20 and 26) bounds the inner half of the foramen ovale behind; the passage for the nerve, as may happen in anthro-

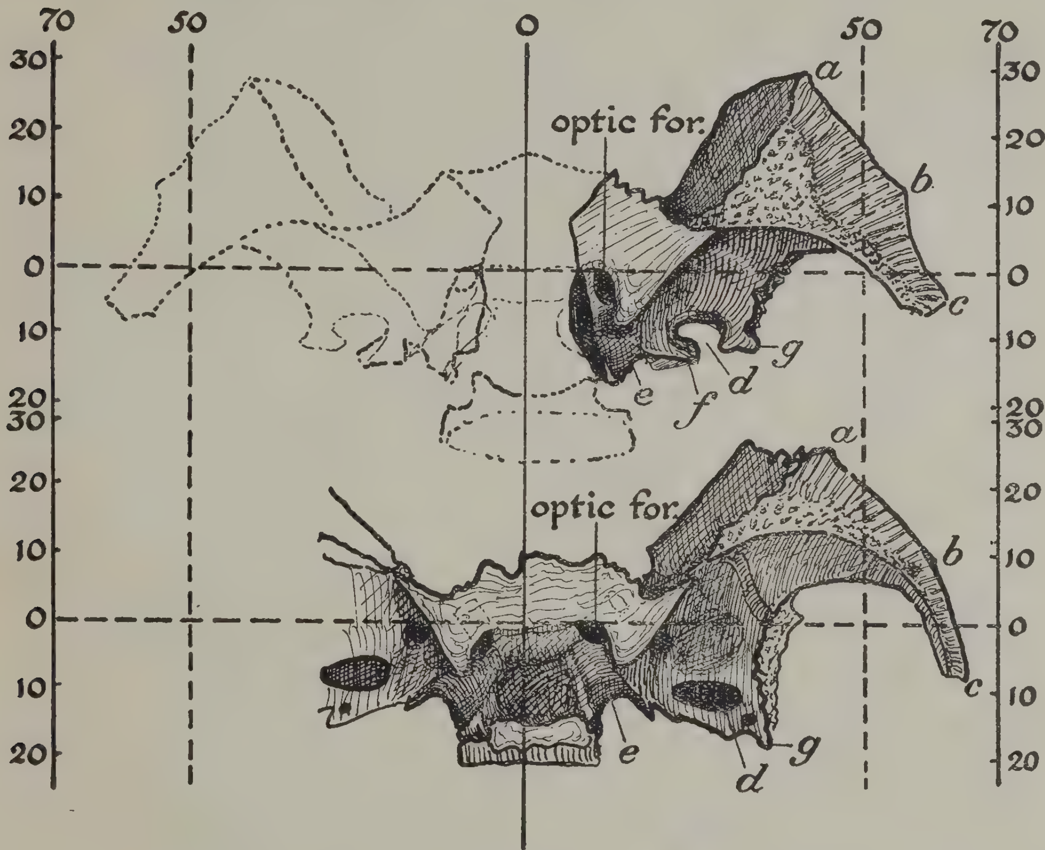


FIG. 26

A view of the intra-cranial aspect of the sphenoid of the Galilee skull oriented on the plane of the lesser wings. Below it is placed a drawing of a modern sphenoid oriented on the same plane. The latter has inadvertently been placed 2 mm. too far to the right of the mid-line. The lateral stippled lines are 50 mm. from the mid-line; the unbroken lateral lines 70 mm. from the same. *a-b.* Fronto-sphenoid suture of the ali-sphenoid. *b-c.* Spheno-parietal suture of the ali-sphenoid. *d.* Foramen ovale. *e.* Carotid groove. *f.* Retroneural process of bone. *g.* Sphenoidal angle or spine.

poid apes, is a notch on the hinder margin of the alisphenoid; (3) a blunt process of bone bounding the nerve passage on its outer side and representing the spine of the sphenoid; in reality there is no downward projection of bone to represent a spine.

The outer or squamous border of the great wing has a thickness of 5.5 mm. and

shows a serrated bevelled margin. The chord of this border measures 41 mm. in the Galilee bone, 45 mm. in the modern; the arc of the former is 49 mm.; of the latter 60 mm. The thickness of the sutural surfaces between the alisphenoid and frontal is altogether remarkable; these surfaces are drawn to scale in fig. 26. The length of the spheno-frontal suture in the Galilee skull is 24 mm., of the spheno-parietal 18 mm. The lesser wing measures from its anterior border to the point of the anterior clinoid process 20 mm. The optic foramen measures 5×4.5 mm., the inner margins of the two foramina being 20 mm. apart. The foramen rotundum measures 5.5×3.5 mm.; the foramen ovale 6×4 mm.; the sphenoidal fissure 9 mm. wide by 12 mm. deep. The width of the pterygoid process at its root is 23 mm.; its antero-posterior diameter 19.5 mm. The Vidian canal commences in a deep fossa above the root of the pterygoid process (fig. 20). Other measurements can be obtained from the various drawings given in the illustrations of this paper.

Another peculiar feature requires special mention. As may be seen in fig. 14 the orbital surface of the great wing is divided by a transverse ridge into an upper and larger area and a lower and smaller. The latter lies in the spheno-maxillary fossa. On it is a deep transverse groove caused by the zygomatic branch of the maxillary division of the fifth nerve.

Characters of the Face.

The features of the forehead, supraorbital ridges, and orbits have been dealt with already (pp. 63 and 73). The actual data which we have to guide us in rebuilding the missing parts of the face are given in figs. 13 and 14. It is possible that in these figures I have underestimated the size of the teeth and of the palate and perhaps the degree of the sub-nasal prognathism. One can safely infer that the total or bizygomatic width of the face was about 136 mm., 6 mm. more than in the Gibraltar skull, and 9 mm. less than in the La Chapelle. The bizygomatic width is less than the mean for Australian male aborigines. The width of the face at the lower ends of the malo-maxillary suture in the Gibraltar skull is 100 mm.; this width in the Galilee skull was a little more—about 104 mm.; in the La Chapelle skull it was only 98 mm.; in the Rhodesian skull 103.5 mm.; in the skulls of Australian male aborigines 94.3 mm. Clearly the lower or masseteric part of the Galilee face was wide. As to the length of face we have only a fragment of the wall of the maxillary sinus to guide us. One infers that the length of the face, from nasion to alveolar point, was about the same as in the Gibraltar skull, 76 mm.

PART II

Description of the Endocranial Cast and Features of the Brain

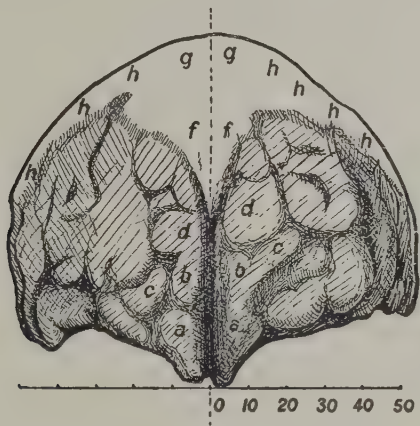
From the dimensions of the frontal and sphenoid bones, and from a comparison of these bones with others in skulls of known capacity, I came to the conclusion that the cranial capacity of the Galilee skull, when intact, must have been about 1,400 cubic centimetres. Here I propose to add certain measurements made upon the endocranial cast taken from the Galilee frontal bone. Photographs of the cast, in profile and in full face, are reproduced in Plates XXI, XXII, and XXIII. The bifrontal width of the cast, measured between the most prominent points of the inferior or third frontal convolution of each side, is 105 mm.; in the skull this width measured 103 mm. The following are corresponding measurements taken on endocranial casts: of a male gorilla, 83 mm.; of Pithecanthropus, 91 mm.; Australian aborigine, 88 mm.; another, ditto, 99 mm.; Gibraltar, 108 mm.; Rhodesian skull, 103 mm.; Neanderthal skull, 110 mm. Thus in this important diameter the Galilee brain greatly exceeds that of Pithecanthropus and of many Australian aborigines, but falls short of the better-known representatives of the Neanderthal species, and also far short of the dimensions found in the better developed European brain, in which the bifrontal width often reaches or exceeds 115 mm. Two measurements relating to the height of the frontal part of the Galilean brain are worth recording; one, the distance from the presphenion—the point on the presphenoid midway between the anterior borders of the optic foramina—to the internal bregma measures 88 mm. in the Galilean endocranial cast; in the Gibraltar cast this diameter measures 77 mm.; in a cast taken from an Australian aborigine's skull, one frequently used in this paper for purposes of comparison, 91 mm. The other measurement, one which serves better as an index of height, is taken from the lowest level of the temporal lobes to the position of the internal bregma—the endocranial cast for purposes of measurement being placed in the Frankfort plane. This temporo-bregmatic height in the Galilee endocranial cast measures 110 mm., an amount which is frequently observed in endocranial casts taken from skulls of Australian aborigines. In the Gibraltar skull the temporo-bregmatic height is 92 mm.; in the Rhodesian skull, 100 mm. We again see that as regards height, just as regards width, the Galilee brain, in its frontal part, was of such dimensions as might be expected in a modern brain having a mass of about 1,400 cubic centimetres. The Galilee cast, measured along its sagittal curvature from the position of the foramen caecum to the position of the internal bregma, gives a distance of 110 mm., the same as the Rhodesian

brain-cast, but 5 mm. more than on the Australian cast I have used here for comparison. In Pithecanthropus, which had a relatively long frontal bone, the corresponding measurement was about 94 mm., 16 mm. less than in the Galilee cast. A measurement of the coronal curvature is also instructive. On the right side the distance from the internal pterion to the internal bregma, taken along the coronal margin, measured 107 mm.; on the left side 100 mm. Such measurements occur on endocranial casts of moderate size, both of Australians and of Europeans. These measurements are given to satisfy the reader that the Galilee person had a brain which, in the dimensions of its frontal and temporal parts, more than attained the level reached by women of the lower living races of mankind.

Cerebro-spinal cisterns of the vault.

In casts taken of the brain-chamber of human skulls, both ancient and modern, there are certain features for which I have sought to find an explanation these twenty years past, but hitherto with no success. In the course of my investigations on the endocranial casts taken from the Galilee fragment, first by Mr. William Finerty and afterwards and more successfully by Mr. F. O. Barlow, I was led up to what I believe to be their true explanation—for these features are very apparent on the Galilee endocranial cast. This cast shows, between the right and left frontal poles, a deep median groove, 9.5 mm. deep, at its deepest, and 9 mm. wide from one margin to the other; this groove is caused by the internal median crest of the frontal bone. Each side of the margin of the groove is bounded by the paramedian part of the frontal lobe; this paramedian area shows the impress of paramedian convolutions—four in number on each side—lettered *a*, *b*, *c*, *d* in fig. 27. Professor Elliot Smith has drawn attention to these paramedian frontal eminences in a Piltdown frontal bone (*Quart. Journ. Geol. Soc.*, 1917, vol. lxxiii, p. 7). They are to be seen in all endocranial casts taken from human skulls. At the upper end of the median groove of the endocranial cast the paramedian convolutionary impressions cease to be distinct (fig. 27); they are masked by a system of subarachoid cisterns which overlie the convolutions and, so far as I can learn, have hitherto escaped notice. The investigations of Professor Louis H. Weed, of Johns Hopkins University, and of Professor Cushing of Boston have revealed the fact that cerebro-spinal fluid is being continually secreted by the choroid plexuses within the ventricles of the brain and is constantly streaming upwards to the vault, to be absorbed by Pacchionian bodies placed in connection with the great blood sinuses of the brain—in particular with the great longitudinal venous sinus which passes along the median line of the vault of the skull from root of nose to occiput. The elevation which we see commencing on the Galilee endocranial cast (fig. 27, *f f*) at the upper end of the depression for the

median frontal crest, marks the point where the stream of cerebro-spinal fluid, which ascends on the mesial surfaces of the cerebral hemispheres, escapes on the upper surface to form the right and left *paramedian frontal cisterns*. These cisterns rapidly become wider and deeper as they pass towards the region of the bregma, thereby masking the convolutionary elevations on the upper and posterior parts of the superior frontal areas of the brain. Thus on the calvarial surface of the Galilee endocranial cast, as on casts taken from the interior of all human crania, there are to be observed two sets of impressions; first those caused by the outstanding convo-



GALILEE

FIG. 27

A sketch of the Galilee endocranial cast, viewed from the front, to indicate the position of the convolutionary impressions and of other elevations caused by subarachnoid cisterns. The cast was poised in the plane represented in fig. 13. *a*, *b*, *c*, *d*, paramedian convolutionary impressions; *f*, *g*, paramedian frontal cisterns.

lutionary areas of the brain; secondly, those caused by permanent cisterns of cerebro-spinal fluid. No endocranial cast shows those two sets of impressions more clearly than that taken from the skull of Pithecanthropus; in that cast the impresses of convolutions and of cisterns are almost diagrammatic in the sharpness of their definition. So are they, too, in the cast taken from the Neanderthal calvaria. The convolutionary impressions are more distinct in young than in old adults; in old age the areas of the cisterns extend; fluid collects between the convolutionary elevations and the overlying calvarial wall, and when this happens the impressions which these elevations had made on the interior of the cranial wall are obliterated. In the three endocranial casts used in this paper for comparison—the Neanderthal, the Australian

(No. 706 D of the R.C.S. Collection), and Pithecanthropus—the convolutionary impressions have the distinctive clarity seen in the earlier years of adult life, and this too is the case in the Galilee cast.

Another cistern is well marked in the Galilee cast (fig. 27, *h*, *h*, *h*). This I propose to name the *subcoronal cistern*, as it lies under the coronal suture extending to a variable extent forwards to lie under the frontal bone and backwards to lie under the parietal bone, especially as this cistern approaches the region of the bregma. The subcoronal cistern commences below in the anterior end of the fissure of Sylvius. Here the cerebro-spinal fluid makes its escape from the great cisterns situated along the base of the brain and passes into the subcoronal cistern, which conducts the fluid to the great paramedian or parasagittal cisterns where absorption takes place. As may be seen from fig. 27 the subcoronal and frontal paramedian cisterns fuse together to form a common chamber. Under the anterior third of the parietal bone, on each side of the sagittal suture, is to be seen a backward extension of this common cistern. The other cisterns of the calvarial aspect of the brain do not concern us here. In the Galilee cast the subcoronal cistern is well marked and obscures the convolutionary impression of the hinder parts of the middle and superior frontal convolutions.

The two cisterns I have just described help us to explain certain markings to be seen on the roofs of skulls—particularly skulls which are supposed to represent a primitive type. The curious sagittal crest seen on the upper half of the frontal bone of Pithecanthropus, Rhodesian man, etc., are well known; there can be no doubt that these external elevations are caused by the frontal paramedian cisterns. In the same skulls the coronal suture is seen to run along a wide elevation or ridge of bone, this elevation being demarcated behind by what is called the post-coronal depression. The coronal elevation is an outward expression of the degree to which the subcoronal cistern is developed. These cisterns are scarcely recognizable on endocranial casts taken from the skulls of anthropoid apes; they are, as we have just seen, highly developed in casts taken from the skulls of primitive races; they are less localized in casts taken from "well-filled" modern skulls. In the Galilee endocranial cast they reach a degree of development often seen in modern skulls. In living long-headed men in whom the vault of the skull has been exposed by baldness, the sagittal frontal crest and the right and left coronal elevations, with the post-coronal wave of depression behind them, can often be recognized very clearly, but I do not think that their presence is any sign of mental inferiority.

I now pass to the interpretation of the convolutionary impressions to be seen in the Galilean endocranial cast (figs. 27, 30, and 36). This part of my task has been made easier by the pioneer investigations which Professor Boule and Professor

Anthony have made on the casts taken from two skulls of the Neanderthal type—La Chapelle and La Quina (*L'Anthrop*, 1911, vol. xxii, p. 1; *Journ. of Anat.*, 1917, vol. li, p. 95). Professor Anthony observed that a description of the fissures and convolutions to be seen on endocranial casts was rendered difficult by the lack of agreement amongst international anatomists as to the naming of parts, and that this task was complicated still further by a profound difference of opinion as to how the simpler arrangement of convolutions and fissures, to be seen in the anthropoid brain, became converted into the elaborate arrangement which marks all human brains. This discrepancy of interpretation is well brought out in a recent paper which Professor Eugen Dubois has published (*Kon. Akad. Wetensch. Amsterdam*, 1924, vol. xxvii, p. 273) on the endocranial cast of Pithecanthropus—a cast which has to enter into the comparison I have now to make. Professor Dubois is of opinion that in the passage from an anthropoid to a human stage, the orbital surface of the frontal lobe underwent an enlargement and thus came to be thrust outwards so as to occupy a position on the lateral aspect of the brain. Whereas most other anatomists, amongst whom the present writer is to be included, think exactly the opposite has happened; they are convinced that it is the lateral aspect of the frontal lobe which has undergone expansion, and that the lower or orbital area has become restricted and thrust downwards and inwards.

As the object of my investigation is to ascertain whether or not the Galilee brain, in its frontal parts, marks a stage in the advance from the anthropoid to the highest human stage, it is necessary to be clear as to the use I make of terms and also as to my identifications on the human brain of parts to be recognized on the brains of anthropoid apes. I therefore give, in fig. 28, a drawing, as seen in true profile, of the frontal parts of an anthropoid brain and another of the same aspect of a human brain.

Until I commenced my investigations of the Galilean endocranial cast I believed that the investigations of the late Professor Cunningham (*Royal Irish Acad. Mems.*, Nos. 6, 7, 1892), and particularly those of Professor Elliot Smith (*Catalogue of the Physiological Series of the Museum of the Royal College of Surgeons*, 1902, vol. ii, pp. 427-463) had established beyond doubt that the fronto-orbital fissure of the anthropoid brain (fig. 28 A, *f*, *o*) became the anterior limiting sulcus of the Island of Reil in the human brain; the condition seen in many gorilla and chimpanzee brains seemed to settle this as a true homology. Yet the conclusion I have been forced to accept is that the fronto-orbital sulcus of apes has been pushed far in advance of the Island of Reil and occupies the position shown in fig. 28 B (*f*, *o*). In this figure the island is completely covered by the surrounding opercula, but in the anthropoid brain an area marked *g* is exposed, but I do not think this area

is truly part of the insula, but represents part of the orbital operculum of human brains. Only an examination of the microscopical structure of its cortex can settle this matter.

The manner in which I reached this conclusion was from a study of that part of the third frontal convolution which forms such a prominent feature of endocranial casts taken from all higher primate skulls, and to which Professor Anthony has given the convenient name of " cap "; it forms a large part of the third or inferior

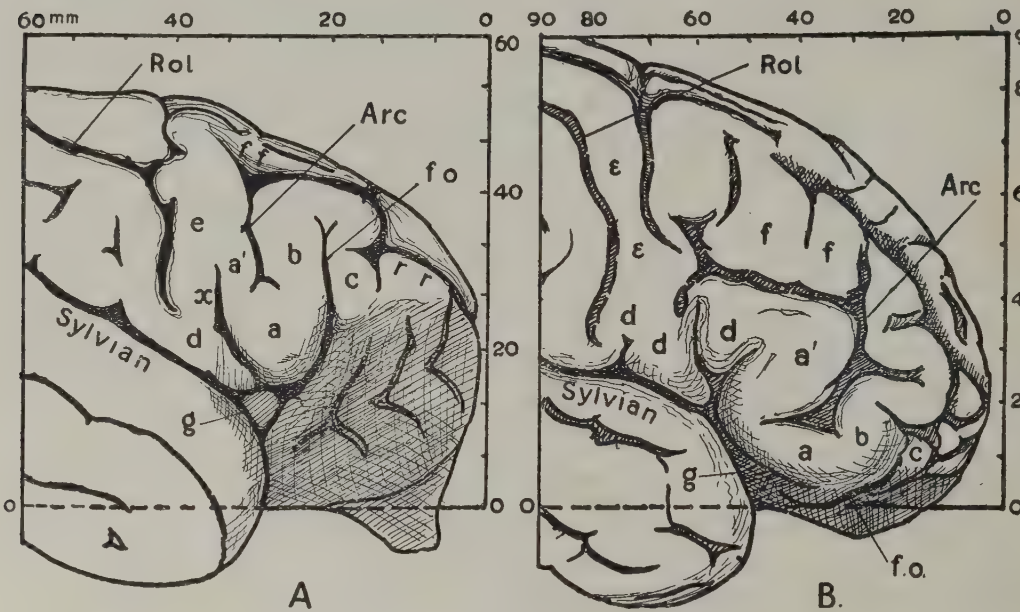


FIG. 28

A. The brain of a chimpanzee; it was enlarged so that its total length became equal to that of the human brain shown beside it for comparison. B. Drawing of a human (male) brain which was hardened within the skull and then cast in plaster by the late Professor Johnson Symington. The scale is marked in millimetres. Explanation of letters is given in text.

frontal gyrus. The cap is readily recognized and defined on the endocranial casts of all the higher primates. No matter what frontal bone we take up, macaque's, gibbon's, chimpanzee's, orang's, gorilla's, or man's we shall find in it a definitely marked fossa for the reception of the cap. This fossa lies just where the floor of the anterior fossa turns upwards to join that lateral part of the frontal bone which lies in the floor of the temporal fossa; the cap is always covered by the origin of the anterior fibres of the temporal muscle. As Schwalbe has stated, the cap often gives rise to an eminence which can be felt under the anterior temporal fibres in the heads

of living races. The fossa for the cap always ends posteriorly at the same sharp margin—the bony falx—which separates anterior from middle fossa of the skull. This falx lies in the stem of the fissure of Sylvius; its inner aspect is always lined by the frontal bone. Anteriorly the fossa for the frontal cap extends a little beyond where the lateral frontal wall turns inwards on the forehead.

If we remove the lateral or temporal area of the frontal bone in the heads of monkeys or of anthropoid apes and thus expose the cap, we observe that a certain sulcus enters the cap and has a very definite and constant relationship to it. The cap as it appears in the chimpanzee's brain is shown in fig. 28 A; it is formed by a loop-shaped convolution, *a* forming the convexity of the loop (inverted), *a'* its posterior limb, and *b* its anterior limb. Within the cap begins the ascending limb of the arcuate sulcus. The cap is bounded anteriorly by the fronto-orbital sulcus (fig. 28, *f*, *o*), but it will be noticed that the anterior limb of the cap turns round the upper extremity of the fronto-orbital sulcus to become continuous with the convolutionary eminence C. Behind, the cap is limited by a vertical sulcus (fig. 28, *a*, *x*) to which most British anatomists would give the name "inferior transverse sulcus." It will be observed, in fig. 28 A, that the ascending limb of the arcuate sulcus, after passing for some distance, joins its horizontal limb at *f*, *f*. This latter limb runs towards the frontal pole and ends in a fissure which I suppose to represent the *sulcus rectus* of the brain of the macaque.

In fig. 28 B the cap of a modern human brain (that of an Ulsterman) is shown. The simple inverted convolutionary loop of the chimpanzee's brain has become transformed into a contorted series of convolutions surrounding the main fissure or sulcus of the cap. In the chimpanzee's brain this sulcus is the ascending limb of the arcuate; in the human brain we no longer recognize the fissure by this name, but call it the inferior frontal sulcus. In figs. 28 A and B both the anthropoid and the human specimens were oriented on the same plane (sub-cerebral); in the chimpanzee the cap is high above this plane and situated just above the pole of the temporal lobe; in the human brain the cap has not only undergone an enormous expansion, but has, by the growth of the lower precentral cortex, been carried in a forward and downward direction. The increase of skull area needed to cover this great expansion of the brain was obtained at the coronal suture—by addition to both frontal bone and parietal, as well as to the great wing of the sphenoid. The forward and downward expansion of the frontal cap in the human brain has carried the fronto-orbital sulcus downwards and forwards and greatly reduced its limits (fig. 28 B, *f*, *o*). The ascending limb of the arcuate fissure, owing to the breaking up and elaboration of the somewhat simple convolutionary loop of the anthropoid brain, has assumed the complex and variable form which is always seen in the inferior frontal sulcus of the

human brain. The fronto-orbital sulcus has not only been greatly shortened and thrust on to the orbital surface, but the convolutions which bound the upper end of this sulcus have also been curtailed (compare figs. 28 A and B). The sulcus rectus has also been reduced, pushed towards the frontal pole, and forms the series of sulci described under the name of fronto-marginal. There has, in particular, been a great expansion of the area marked *f f* in fig. 28 A. I suppose the sulcus medius

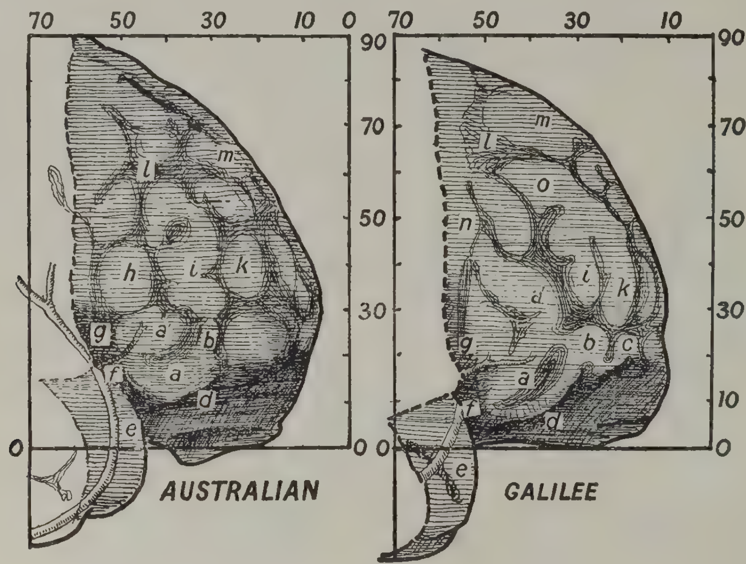


FIG. 29 FIG. 30

FIG. 29. The frontal region of an endocranial cast taken from the skull of an Australian male aborigine (No. D 702, R.C.S. Museum). The parts represented are those covered by the frontal bone and by the great wing of the sphenoid. The parts were drawn in true profile, with the specimen oriented in the sub-cerebral plane.

FIG. 30. A similar drawing of the endocranial cast of the Galilee skull.

Both specimens are enclosed in a framework of lines of the same dimensions—namely, 90 mm. high and 70 mm. long.

of the human brain to represent the horizontal limb of the arcuate sulcus of the ape's brain. I want here to restrict myself to the interpretation of the frontal cap as seen in the endocranial cast of the Galilee skull and in other fossil skulls of primitive man. Fortunately a very full discussion of the homologies of the fissures and sulci of human and anthropoid brains has been published recently by Dr. G. E. Genna (*Rivista di Antropologia*, 1924, vol. xxvi, pp. 1-157, 7 Pls.), so there is no need to discuss these problems further here. Dr. Joseph B. Shaw has also made a long

series of observations on the extreme degree of variability of the frontal sulci and convolutions of the human brain, and published charts of the localization of cortical areas observed by others with criticisms founded on his own enquiries (*Brain*, 1910, vol. xxxiii, p. 26). Professor Elliot Smith has also published an account of the areas of the cortex as marked out by the pattern of their microscopical structure (*Journ. of Anat.*, 1907, vol. xli, p. 237). Whether or not I am right in homologizing the anterior end of the inferior frontal sulcus of the human brain as the equivalent of the lower end of the ascending limb of the arcuate fissure of the anthropoid brain will be determined by its relationship to corresponding areas of frontal cortex. So far as published, cortical charts favour the interpretation I have given of the inferior frontal sulcus of the human brain.

In order to save description I have given, in fig. 30, a drawing of the various eminences and depressions seen on the right aspect of the frontal and sphenoidal regions of the Galilee endocranial cast and placed beside it, in fig. 29, a similar drawing, made from the endocranial cast of an Australian aborigine. So far as concerns area, as seen in profile, there is not much difference between the two specimens thus represented; the Australian specimen is the more compressed from side to side and therefore seems the larger as viewed in profile; the Australian specimen has the more complex convolutionary pattern. In both the cap, *a*, is well defined; the cap is bounded anteriorly by the fronto-orbital sulcus, *d*, while, behind, it is demarcated by the stem of the fissure of Sylvius, *f*, wider and more open in the Galilean specimen because of the massiveness of the falx of bone which occupies the stem in skulls of the Neanderthal species. Above *f* is a vertical shallow depression which probably marks the ascending limb of the fissure of Sylvius; this depression limits the cap posteriorly. In the Australian specimen the inferior frontal sulcus commences in the cap, ascends between *a'* and *b*, which represent the limbs of the loop of the anthropoid cap (fig. 28); then it ascends between *h* and *i*, which indicate elevations on the inferior and middle frontal gyri. In the Galilean cast there is on the cap at *a* an isolated depression which may or may not represent a separated part of the inferior frontal sulcus. This sulcus becomes well marked as it ascends between *a'* and *i* to terminate in front of the coronal suture at *n*. It is more highly placed on the lateral aspect of the Galilean frontal region than in the Australian specimen, and a high position may be regarded as a primitive mark. In both specimens there is a well defined fronto-marginal depression which I regard as the equivalent of the straight sulcus of the anthropoid brain. In both specimens the fronto-marginal sulcus crosses the middle frontal convolution between *c* and *k*, and in the Galilean specimen joins the inferior frontal sulcus between *b* and *i*; this junction is slightly indicated on the Australian cast. In both drawings *l* marks the upper end of the

superior frontal series of sulci; *m* is placed high up on the superior frontal gyrus. Thus, although a series of similarities can be traced between the markings on the Galilean and Australian endocranial casts, there is also evidence of many points of difference. The conclusion which my comparison has forced on me is that the Galilean is somewhat the more anthropoid in type.

In fig. 31 are represented the areas covered by the frontal bone and great wing of the sphenoid in the gorilla. The drawing was made from the endocranial cast of a

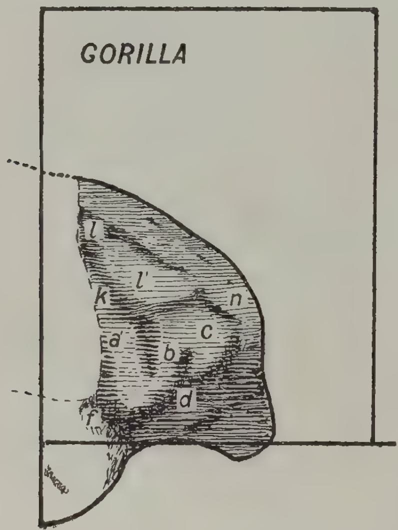


FIG. 31

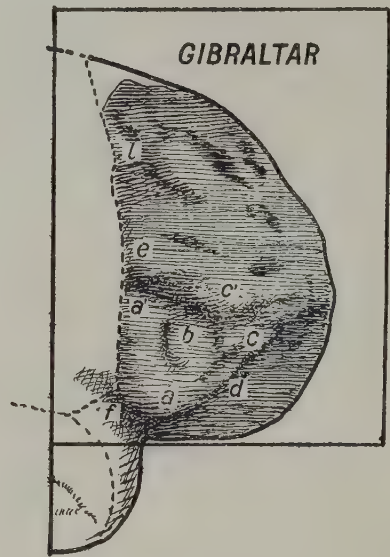


FIG. 32

FIG. 31. A drawing in profile of those parts of the endocranial cast of a gorilla which are covered by the frontal and sphenoid bones (No. O 662, R.C.S. Museum).

FIG. 32. A similar drawing of the same parts of the endocranial cast of the Gibraltar skull.

Both specimens were oriented in the sub-cerebral plane, and placed within the same framework of lines as is shown in figs. 29, 30.

young animal with a cranial capacity of more than 500 cubic centimetres, and has been placed in the same framework of lines as before in order that the reader may realize how much the frontal and sphenoidal areas of the lowest human brains exceed those of the highest anthropoid. For comparison with fig. 31 I have given a corresponding drawing of the endocranial cast of the Gibraltar skull, which has the lowest capacity of any known Neanderthal specimen. Unfortunately, convolutionary eminences and furrows are not well marked on the Gibraltar cast. In both are to be seen the cap, *a*. The inferior frontal (or arcuate) sulcus is seen to commence within

the cap in the cast of the gorilla's brain and to ascend to, and effect a union with, the superior frontal sulcus at *l*. The two convolutionary limbs of the cap are represented by *a'* and *b*. In the Gibraltar cast there is an isolated depression which I take to indicate the beginning of the inferior frontal sulcus; the main part of this sulcus is indicated by a depression which lies between *a'* and *e* (fig. 32). In both the cap is limited anteriorly by the fronto-orbital sulcus; below and behind there is the depression of the Sylvian stem *f*. In the gorilla cast the Sylvian depression

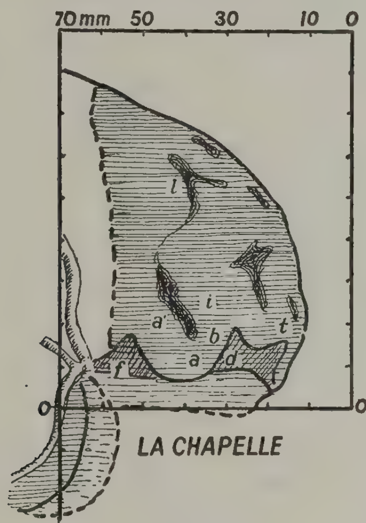


FIG. 33

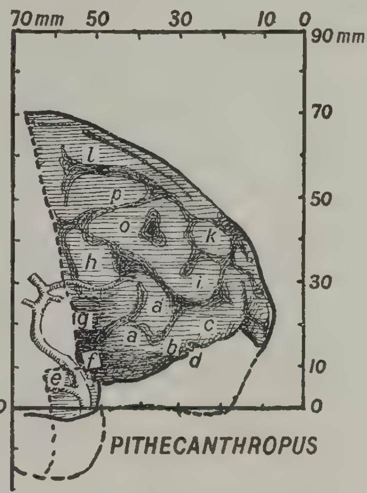


FIG. 34

FIG. 33. The frontal region of the endocranial cast of the La Chapelle skull (after the drawing given by Prof. Anthony, *L'Anthrop*, 1911, vol. xxii, p. 13).

FIG. 34. Profile drawing of the eminences and furrows on the frontal region of the endocranial cast of Pithecanthropus.

Both specimens were oriented as before, and the drawings, made to scale, placed within the same framework of lines as have been employed for the other specimens depicted in this paper. The scale is marked on the surrounding lines in millimetres.

is wide and shallow; in the Gibraltar cast this depression has become deep owing to the great expansion of the frontal cap and of the polar parts of the temporal lobe. In the gorilla cast a depression cuts across the middle frontal gyrus between *c* and *l'* and joins the inferior frontal with the superior frontal sulcus. This depression I take to represent the straight sulcus of the anthropoid brain and the fronto-marginal of the human. Its representative in the Gibraltar cast I take to lie between *c* and *c'*, occupying a position just above the orbital margin, having been forced into this

low situation owing to the expansion of the upper and hinder frontal areas. In fig. 31 *n* is placed on the superior frontal gyrus. In the human brain, as seen in fig. 32, the middle and frontal convolutions are enormous compared to those of the gorilla.

In fig. 33 is reproduced a drawing of the frontal region of the large endocranial cast of the La Chapelle skull, copied from Professor Anthony's illustration—which apparently represents a tracing made from a photograph of the original cast and does not therefore represent parts in their true dimensions. The skull, too, was somewhat broken and defective in the sphenoidal and lower frontal regions. The cap, *a*, is very well seen; in it commences a depression which I take to represent the lower end of the inferior frontal sulcus. This depression is bounded behind by *a′*, which represents one limb of the convolutionary loop of the cap, while *b* marks the other loop (see fig. 28 A). The fronto-orbital sulcus is represented at *d*, while the stem of the Sylvian fissure is represented at *f*. The upper of the series of superior frontal sulci is represented at *l*, while *t* is placed on the inferior or beak part of the superior frontal gyrus.

To compare with this and other illustrations of the frontal region I give in fig. 34 a profile drawing of the parts as seen in the endocranial cast of Pithecanthropus, the condition seen in this cast being certainly the oldest and most primitive stage in the evolution of the human frontal region—so far as such stages are at present known. The cap, marked by *a*, is much smaller than in the other human brains figured here; above *a* begins the inferior frontal sulcus, which ascends in a backward and upward direction, to end by bifurcating above *h*. One branch descends and forms what is usually described in human anatomy as the inferior limb of the precentral sulcus; the other crosses over the middle frontal gyrus to join the series of superior frontal sulci. This branch may represent the upper limb of the arcuate sulcus of the ape's brain; the other part, which descends to the cap, representing the lower limb of the arcuate. *a′* and *b* I regard as the two limbs of the cap. The stem of the fissure of Sylvius, which is wide and relatively shallow, is marked by *f*; the depression indicated by *g* lies over the ascending limb of the fissure of Sylvius; the fronto-orbital sulcus ends at *d*. The fronto-marginal sulcus—sulcus rectus of the ape's brain—is seen to cross the middle frontal gyrus, between *c* and *i*, and to thus unite the inferior frontal sulcus to the lower of the series of superior frontal sulci. A comparison of figs. 31, 34, 30, 29 shows that the frontal region of the brain of Pithecanthropus had risen far above the anthropoid stage, and that it is altogether human in the elaboration of its convolutions and sulci. When the Australian and Galilean casts (figs. 29 and 30) are compared to that of Pithecanthropus it is seen that in the size and arrangement of its frontal parts the Galilean cast makes a nearer approach than the Australian to the condition seen in Pithecanthropus.

In figs. 35, 36, and 37 I represent a descending series of steps in the evolution of the frontal region of the human frontal region. As everyone who has looked into the matter knows full well there is a great discrepancy in the arrangement of convolutions and sulci on the two sides of the same human brain, particularly between the right and left frontal regions. In fig. 35 the arrangement of convolution is shown on the left frontal region of the Australian cast which provided the drawing of the right frontal region shown in fig. 29. The cap is missing from the casts of the Galilean and ancient Javanese individuals. It is not necessary to recapitulate the

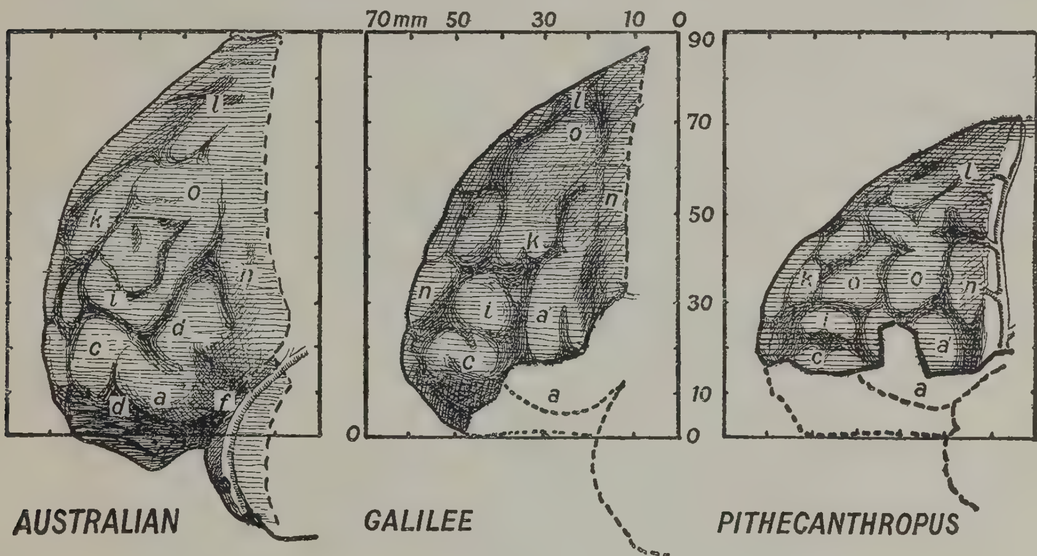


FIG. 35 FIG. 36 FIG. 37

FIG. 35. A profile drawing of the left frontal region of the endocranial cast from the skull of an Australian aborigine (see fig. 29).

FIG. 36. A similar drawing of the left frontal region of the Galilean endocranial cast.

FIG. 37. A similar drawing of the left frontal region of the endocranial cast of Pithecanthropus.

points of comparison already made on the right sides of these specimens. A glance at the drawings shows that the frontal part of the brain in the Galilee skull—both in size and in elaboration of convolution—rises high above the same region of the brain in Pithecanthropus; the Australian brain, low as it is among those of a modern type, marks a higher degree of elaboration than that seen in the Galilean specimen. Between the stage represented in Pithecanthropus and that seen in the Galilean brain are several missing stages, whereas it seems but a single step from the Galilean to the stage seen in Australian aborigine. It will be evident from these three figures that in progressive stages of evolution the frontal region of the brain tends to expand

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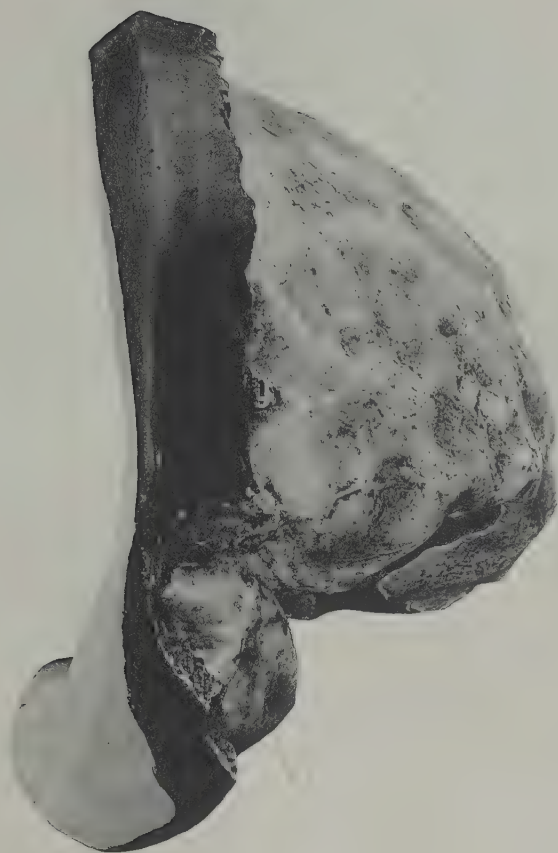
and turn forwards and downwards, as if on a horizontal axis drawn through the insular regions. The greatest expansion of the frontal region, after a human status was attained, seems to have taken place in the upper and middle regions of the superior and middle frontal gyri. Unfortunately our knowledge of the areas, convolutions, and furrows of the frontal region of the human brain has not yet reached that stage which permits us to say that this part or that marking has such and such a meaning; we cannot yet read the functional capacities of any given human brain by a study of its external appearances. We have every right to believe that our knowledge will increase, and that some day experts will be able to determine the functional significance of the appearances seen on such endocranial casts as that obtained from the Galilean frontal bone. In the meantime we have to be content to say that the comparison of this cast with others leaves us in no doubt as to the human status of the woman of Galilee; in its mass and in its markings her brain reached at least to the level attained by individuals in living races—such as that represented to-day by the aborigines of Australia.

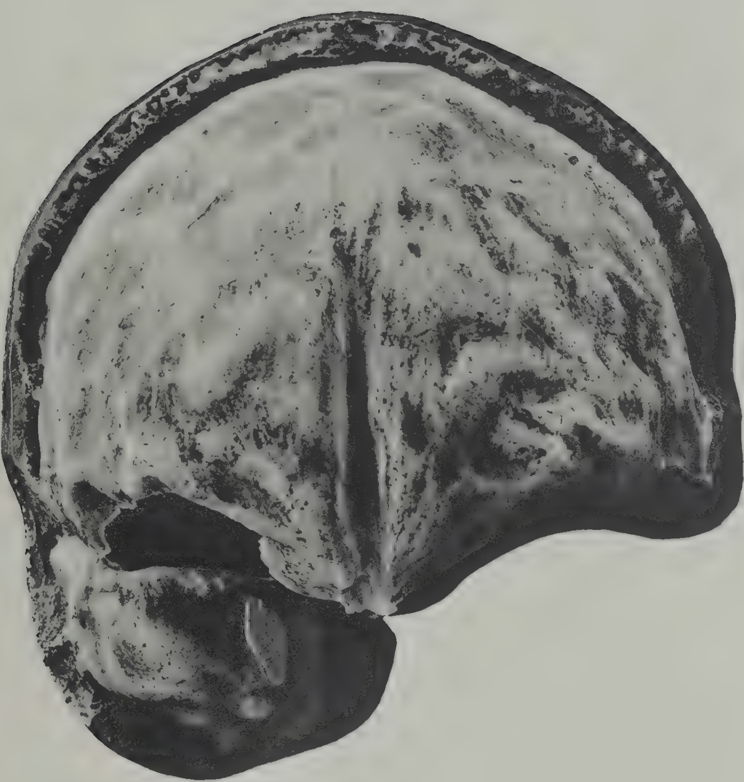
Photograph of the Galilee cranial fragment, oriented in the Frankfort plane and viewed on its right profile (Nat. size).

Photograph of full face of the Galilee cranial fragment, oriented on the Frankfort plane (Nat. size).

Photograph of the Galilee cranial fragment from behind, oriented as before (Nat. size).



Endocranial cast photographed on its right aspect.



Endocranial cast viewed from the front.

FRONT VIEW OF THE ORIGINAL ENDOCRANIAL CAST TAKEN OF THE GALILEE SKULL, WHICH SHOWS CERTAIN FEATURES BETTER THAN THE FINAL AND OFFICIAL CAST.

APPENDIX

SOUNDINGS IN CAVES IN VICINITY OF PLAIN OF GENESERETH

After the completion of excavations at Mugharet-el-Zuttiyeh, soundings were carried out in such of the other natural caves of the district as were sufficiently large to have been at any time occupied, but these failed to reveal any further traces of Palaeolithic man.

For the sake of completeness it may here be recorded that, in 1925, trenches were dug in Mugharet-el-'Amud and the Mugharet Shebabik, Wadi 'Amud, but failed to yield any indications of interest.

The soundings were accomplished by means of trenches in the caves, or on the terraces in front of them, and a summarized account here follows. The potsherds have been identified by Père Vincent of the École Biblique at Jerusalem.

Mugharet Sukkara (*Wadi 'Amud*). A high narrow cave with artificial niches high up in the face of the rock. A trench was dug inside the cave to a depth of 130 cm., below which point it was found impracticable to deepen it owing to an accumulation of fallen rock. The following stratification was revealed:

0-20 cm.	Goat dung.
20-50 cm.	Earth and fallen rock: sterile.
50-130 cm.	Earth and fallen rock with potsherds: Roman, Byzantine (?), Early Iron Age, Bronze Age I, Eneolithic (one sherd showing rope pattern in relief).

Cave in Wadi Jereibeh. The cave consists of a long narrow corridor leading to two larger chambers. Two trenches were dug (i) immediately in front of the entrance, where rock was reached at 75 cm.; (ii) in the first of the two chambers. Rock was reached at 25 cm. Sherds of following periods were found:

Arab. Including 3 pipes.
Roman. Numerous. 1 sherd, Arretine ware (?).
Late Iron. 2 fragments of lentoid flasks, and numerous other sherds.

Middle Iron. Numerous. 1 imported Cypriot sherd of white painted ware with geometric panel decoration in dark brown.

1 local imitation of Cypriot ware, brownish yellow with red geometric decoration.

Bronze Age I. *Bronze Age II.* *Bronze Age III.*	Numerous sherds and fragments of lamps. Rough flint flakes and scrapers.

Kalat 'Ibn Maan (*Wadi Hammam*). This is a complex system of caves, to a great extent artificial, with rock cut steps and masonry fortifications. Trenches were dug in the two main natural caves which formed the nucleus round which the later artificial chambers were constructed. (i) In the eastern of the two caves, rock was reached at 50 cm. No pottery or worked flints were found, but a number of squared building-stones. (ii) In the cave farther west, rock was reached at 70 cm. Sherds of following periods were found: Byzantine, Roman, Early Iron Age, Bronze Age I. Also a few roughly-worked flint scrapers, presumably of Bronze Age date.

EXPLORATION OF SITES IN THE WADI FARAH

Having failed to discover in the immediate vicinity of the Plain of Genesereth any further site likely to throw light on the prehistoric cultures of Galilee, it was decided to investigate a district farther to the north, the Wadi Farah and the hills lying immediately to the north of it, overlooking the Huleh Plain (see map, Plate XXIV, A). A camp was established at Deishun, a small village situated directly above the Wadi on its northern side, some three and a half hours' ride due north of Safed. With this village as a centre, five weeks were spent in searching for surface sites, and making soundings in the numerous caves which are to be found in the limestone hills. The Wadi Farah is a broad and comparatively well-watered valley which cuts through the high plateau north of Safed, from the foot of Mount Jermuk to the Huleh basin, and forms one of the principal routes of communication between Lake Huleh and the Galilean hills. Consequently it was to this Wadi itself and the hills immediately overlooking it and the adjoining Wadis that attention was more especially directed. The present stream of the Wadi Farah, now very much reduced in size, and in places waterless in summer, pursues a winding course through the flat and stony valley which must formerly have constituted the bed of an important river sometimes approaching the precipitous cliffs to the north, sometimes those to

the south, but usually leaving (on one side or the other) a low terrace of earth and pebbles laid down by the former river.

(1) *Farah*. Such a terrace particularly clearly defined and lying to the north of the present stream-bed, and some 120 cm. above it, is to be found just below the village of Farah, immediately above the point where the Wadi Farah is joined by its tributary valley, the Wadi Salhah, which separates the plateaux of Farah and Salhah. This low terrace is thickly strewn with large roughly-worked implements, cores, and waste flakes, and at a cursory examination it would seem that it might have been the site of a prehistoric encampment. However, a careful examination of the site and its immediate neighbourhood showed that wherever a comparatively level patch occurred on the slopes immediately above the terrace, implements were to be found in abundance, and by following such indications the site of the original factory was eventually traced to a small plateau not far below the summit of the hill (see Plate XXIV). An area of some 200 metres square is here thickly strewn with implements, and from this site the specimens found in the valley below had gradually slipped down by way of a shallow gulley caused by surface drainage from the plateau above. The plateau on which the site is situated slopes rather steeply towards the south, and is sheltered from the north by the crest of the hill immediately above it. It overlooks the Wadi, from which it is easily accessible.

The site was visited on several occasions, and a very large number of implements was collected; so that there can be little doubt that a complete series of the types made at the site is represented in the collection, which is now in the Palestine Museum, Jerusalem.

The chert, of which the implements are made, is obtainable in abundance in the limestone hills of the district; specimens of the principal types are shown on Plate XXV and may be described as follows:

Coups-de-poing were rare, not more than six specimens being collected. These vary in length from 18 cm. (Plate XXV, figs. a, f) to 12 cm.; the point is drawn out and carefully worked, the butt usually left rough.

Fig. b may be described as a massive pick. The strong point, which has been abraded by use at the tip, has been formed by the removal of four long roughly parallel flakes, the upper surface being flaked in the manner of a *coup-de-poing*.

Another implement extremely common at this site is a rectangular cutter; one of the longer edges is trimmed to form a strong cutting implement; the opposite edge is squared off and blunted to give a firm grasp for the hand. The largest specimen of this type found, measuring 17.5×12 cm., is shown in fig. h, and the

smallest specimen, 8.5×5.5 cm., in fig. k. Another variety of the same tool is fig. r.

Scrapers were very numerous, and may be classified as follows:

(i) Cores circular (fig. e) or oval (fig. g), worked either all round or along one side by removing long flakes at right angles to the base.

(ii) Long narrow cores (fig. d) worked in the same way as (i). These were extremely common.

(iii) Long thick flakes squared at both ends and carefully trimmed along one or more sides (figs. l, p), and similar flakes squared and trimmed at one end only (fig. v). The workmanship on these types was particularly fine.

(iv) Rough flakes or cores of chance shape, roughly trimmed along one or more edges, usually leaving much of the original encrustation (fig. c).

Points, formed (i) by trimming the point of intersection of two adjacent edges ("angle points," fig. i); or (ii) more elaborately produced by delicate retouching at the end of a flake (fig. n); or (iii) a strong borer is produced by removing three parallel flakes by a sort of graver blow directed from the point towards the butt (fig. q).

Blades. Rough flakes of suitable thickness, frequently showing signs of wear along the edges (fig. m). Fig. j shows a more carefully produced long blade flake, while figs. o and u have been blunted along one edge for convenience in holding.

(2) *Shemouniyeh*. A second site showing a culture entirely similar to the above was found on the land known locally as Shemouniyeh, situated on a plateau about an hour's walk above Deishun to the north-west. Implements were less numerous and more weathered than those from the Wadi Farah and are less carefully worked, but show a very similar technique and type series. The following types were found: *Coup-de-poing* (one specimen). Rectangular cutters. Core scrapers of circular form. Small rectangular scrapers formed from stout flakes squared at both ends and worked along one or more edges, or at the end. Roughly worked scrapers on cores or flakes of chance shape. Points like types (i) and (iii) from the Wadi Farah. Rough flake-blades.

The implements from these two sites show some resemblances to "Campignian" types, and in the absence of all stratigraphical evidence may be regarded as mesolithic or proto-neolithic.

(3) *Site East of Deishun*. Immediately to the east of Deishun, between the Weli of Neby-Haniya and the hill known as Khirbet-Khureibeh, is a low hill thickly

strewn with limestone blocks. Among these blocks, small circular and larger rectangular spaces have been cleared especially on the south and west slopes of the hill overlooking the Wadi Farah. Some of these clearings may be of recent date, but the large number of worked flints which are lying about shows that this hill was once the site of a flint-working settlement, and it would seem possible that the smaller circular clearances may mark the emplacement of primitive huts. A trench dug in one of these clearances, however, yielded no evidence. The implements (Plate XXVI, B), of a light greenish or brownish flint, are sometimes rather thickly covered with a yellow patination. They are for the most part of small size; they include small core scrapers and disc scrapers worked round all or part of the edge (figs. p, q, r, s); nosed scrapers (figs. i, j, k); side scrapers worked usually along one steeply sloping side only (figs. a, b, e, t, u, v); small points very slightly retouched at the tip (figs. l, m, n); and natural flakes utilized as blades (figs. c, f, g). Fig. h shows a small pick worked to a cutting edge at one end, but seems also to have been used as a side scraper. Fig. w, a boldly worked scraper, shows one of the very few larger implements found on the site.

It is difficult for lack of comparative material from this part of Palestine, and the absence of all stratigraphical evidence, to establish the chronological position of this culture. The entire absence of potsherds on the site seems to place it definitely prior to the Æneolithic period, and it may perhaps be best regarded tentatively as a transitional culture, falling between the Late Palaeolithic represented in the cave site of El-Emireh (see page 7) and the more developed Mesolithic abundantly represented in Southern Palestine by various stations round Bethlehem (Mallon, *Quelques Stations préhistoriques de Palestine*, Beyrouth, 1925).

(4) *Wadi Salhah.* Not more than ten minutes' walk from the site (1) described above is a small cave situated half-way up the eastern cliffs of the Wadi and accessible only by way of an extremely steep rocky slope. This cave faces due west, measures 12 m. in depth by 9 m. in breadth at the entrance, and 10.80 m. at the centre (see Plates XXVII and XXVIII) and is extremely low, its roof rising to a height of not more than 3 m. above the modern floor level. A preliminary trench was dug from the mouth of the cave inwards towards the back wall. In this trench, bed-rock was eventually reached at a depth of 3.80 m. The face of the trench showed the following stratification:

0-60 cm. Level I.	Light reddish earth with a large quantity of fallen stone; potsherds, but no definite evidence of continuous occupation.
60-100 cm. Level II.	Continuous occupation level. Black lines of decaying organic matter; potsherds; some worked flint; traces of fires.

100-140 cm.	Layer of fallen rock; sterile.
140-220 cm. Level III.	Continuous occupation layer; black lines of organic decay; traces of fires; considerable number of worked flints; very numerous potsherds of rough ware.
220-380 cm. Level IV.	Sterile layer; large quantity of fallen rock; occasional lines of organic decay; no traces of human occupation; resting at 380 cm. on sand, clay, and decomposing rock.

This trench therefore showed that, in two distinct layers, worked flints were to be found associated with pottery, and in view of the desirability of correlating the later phases of flint-working technique with the much better known pottery series, it was decided to excavate the larger part of the cave lying to the south of the trench, down to the bottom of the lower occupation level (Plate XXVII). Before doing this, however, the trench was continued out on to the terrace in front of the cave. Blocks of fallen rock made it impossible here to deepen the trench below 50 cm.; and the fact that potsherds of all periods were found quite near the surface showed that the large fall of rock which had built up the terrace in front of the cave must have occurred before the period of the earlier occupation, and must at that time have formed a kind of natural rampart at the entrance (see Plate XXVIII).

The deposits to the south of the trench were removed, as far as possible in accordance with the layers indicated in the section; but as these layers were in some places not very clearly defined, and burrowing of animals and falls of rock had to some extent disturbed the original stratification, the possibility of the occasional intrusion of objects from a higher level into a layer below that to which they belong is not precluded.

A description of the three layers which yielded evidence of human occupation, and a summary description of the principal objects found in them here follows:

LEVEL I (0-60 cm.) was composed of light reddish earth mixed with a very large proportion of small fragments of limestone fallen from the roof. There were no traces of fires, and potsherds were not very numerous, indicating that, though occasionally visited, the cave was not continuously inhabited at this period. In the upper half of the layer (0-30 cm.) potsherds were all of Arab ware, mostly quite modern. They included a small unbroken juglet with a single handle, probably of mediaeval Arab date. In the lower half of the level (30-60 cm.), though Arab fragments still predominate, Bronze Age sherds and occasional worked flints, obviously derived from the occupation level immediately below, begin to appear.

LEVEL II (60-100 cm.). The earth which formed this layer was of a darker shade than that of the level above, and contained numerous lines of black organic decay. Frequent traces of fires, and an abundance of potsherds, showed the layer to correspond to a period of continued occupation of the cave. Fragments of human bone, all belonging to one individual, were found towards the bottom of the layer.

The Pottery, excepting a few intrusive fragments of Byzantine and Arab types, was typical of Early Bronze Age I (Third Millenium B.C.), characterized by the use of coarse gritty clay, ineffectively refined and badly fired. It was for the most part undecorated, though many fragments were characteristically finished by a red external slip with a burnished surface. There were also a few examples of a black slip on a grey body, usually on the outside of the vessel only, but occasionally also inside. A simple decoration is sometimes provided by uneven firing producing black-and-red variegated effects, and not infrequently by the application of pigments, among which the following motifs occur: horizontal bands of dark red on grey, broad bands of red on pink, irregular washings of dark red on red-fired clay, producing shadowy tree-like effects, vertical lines of creamy white on red, spreading below into some device not complete on the samples.

Incised decorations occur in the form of bands of parallel wavy lines (Plate XXIX, B) and combed-patterns, diagonal and horizontal, produced by a comb comprising usually from six to eight teeth. Pointillé and chevron designs were not apparently used. Some of the large red vessels are decorated with raised bands round the wider part of the jar, treated with rope pattern, or broken with vertical notches at intervals of about 1 cm.

There is a fragment of a spouted vessel of burnished red ware, and fragments of one or two juglets with thin vertical handles.

The fragments of coarse pottery are usually from flat-bottomed expanding vessels; the better pottery is worked over to the complete vase form with neck and wide aperture.

It has been possible to reconstruct provisionally a jar of relatively fine ware with a red burnished slip; this is shown on Plate XXIX, A.

In one specimen at least the wheel seems to have been used in finishing off the neck and rim, but in most cases the specimens are hand-built.

In general there is little suggestion of forms and types not already known from specimens in the museum or from Tell Kussees, published in *Bulletin II*; though on the whole the present series perhaps consists of cruder specimens.

The Flint Implements are for the most part made from local greyish-green flint and are unpatinated. A selection is shown on Plate XXX, A. They consist for the most part of chance flakes showing marks of use as blades (fig. f), roughly worked

cores (figs. a, g) and side scrapers (figs. e, j). A few more carefully worked implements, however, were also found. Fig. h shows a ribbon flake 14.5 cm. long. Fig. i is an axe worked to a strong cutting edge along one side where, towards the point, it shows distinct signs of polishing. The fine points, broken at the tip (figs. b, c), are finished by ripple flaking over part of both surfaces; while the broken blade (fig. d), of fine black chert, has been carefully retouched along one edge and flaked over the whole of the under surface.

The animal remains obtained from Level II include those of a bovine, *Bos* sp.; a ? gazelle, *Gazella* sp.; and a pig, *Sus* sp. Some of the bones are those of very young individuals.

Below Level II and separating it from Level III was a sterile layer consisting of large blocks of limestone; this stone layer was some 40 cm. thick extending from 100 cm. depth down to 140 cm.

LEVEL III (140-220 cm.). The general composition of this level was entirely similar to that of the level above, consisting of darkish brown earth with lines of organic decay and frequent traces of fires. At the centre of the cave, at a depth of 200 cm., was a made-up hearth of small stones mostly calcinated or blackened by heat. Among the debris of this hearth were fragments of two large earthenware vessels. Worked flint was considerably more abundant than in Level II. Potsherds were extremely numerous.

The Pottery is distinguished by a notable absence of the more developed forms and better-made pots present in Level II. There are no small vessels with handles, and no vessels with spouts. It is also noteworthy that the intentional admixture of grit with the potter's-clay, which is a characteristic feature of the pottery of the First Bronze Age, is much less noticeable in the sherds from this level.

The forms of the vessels are of the simplest; the baking is uniformly crude.

Decoration is confined to a few bands of red, or incised wavy lines, probably intrusive from the stratum above, where they are relatively common. There are a few examples of a black or red burnished slip, but for the most part the finish, if any, is provided by a wash of the same colour as the clay. Some of the surfaces are unfinished, and in many cases the baking is quite primitive.

The most distinctive vessels, which are also among the best specimens of pottery, are the large earthenware jars mentioned above (Plate XXIX, E, F). These were of coarse grey ware and unfinished surface. They have a wide mouth with a semblance of a neck, decorated round the shoulder with a notched band, attached to which are straight vertical handles decorated in similar fashion and holed as for suspension, suggesting a motif derived from loops in a carrying-rope (Plate

XXIX, figs. C, D). One piece of neck has a tie hole, made subsequent to baking, presumably for mending a break or crack. One specimen, which, exceptionally, is hard baked, shows traces of a dark red slip outside and inside, and of a handle which has broken away. The bases are flat. These large vessels are hand-built, and it is doubtful whether the wheel has been used on any of the specimens from this stratum.

The Flint Implements, which are numerous, are made of a greyish-green flint similar to the material from Level II and are unpatinated. The technique (Plate XXX, B) is similar to that of the rougher implements from Level II, but no specimens of long ribbon-flakes, axe-heads, or ripple-flaking were found. The commonest types are large scrapers extremely sketchily worked, the shape being left to chance (figs. a, b, c, h), and rough flake blades (figs, j, k, l); a rather better specimen of a blade (fig. g) is made of a fine dark brown chert. The two long rectangular scrapers (figs. d, e) are carefully retouched along both sides, and are of a finer material than most of the implements. The implement shown in fig. f seems to have combined the functions of a strong blade and a scraper; the edge of one of the long sides shows signs of wear; the opposite side has been squared off for convenience in grasping, while the end shows a rough scraper-retouch. Fig. i is similar, but without scraper-retouch.

The animal remains from Level III include those of a bovine, a gazelle, and a pig. The bovine is represented by several upper and lower cheek teeth, most of which agree in size with those of the recent bison from the Caucasus. An upper premolar is slightly larger than corresponding specimens in the recent European bison. This material is insufficient to determine the species, or to say whether it represents a wild or domesticated race.

The gazelle is represented by an imperfect mandibular ramus, and by a horn core similar to some found in the Zuttiyeh Cave; these may provisionally be referred to *Gazella ? subgutturosa*.

Remains of both adult and juvenile individuals are included in this small collection.

Below 220 cm. no evidence of any human occupation of the cave came to light in the trench; consequently there seemed to be no reason to continue the excavations below this point.

Soundings made in the following caves of the neighbourhood show that none of them contains material likely to throw light on primitive culture.

Mugharet Delbi, on the southern cliffs of Wadi Farah, below Deishun. A trench

was dug to rock 1.50 m.; no occupation level; deposits of burnt dung and fallen rock; a few insignificant potsherds of late date.

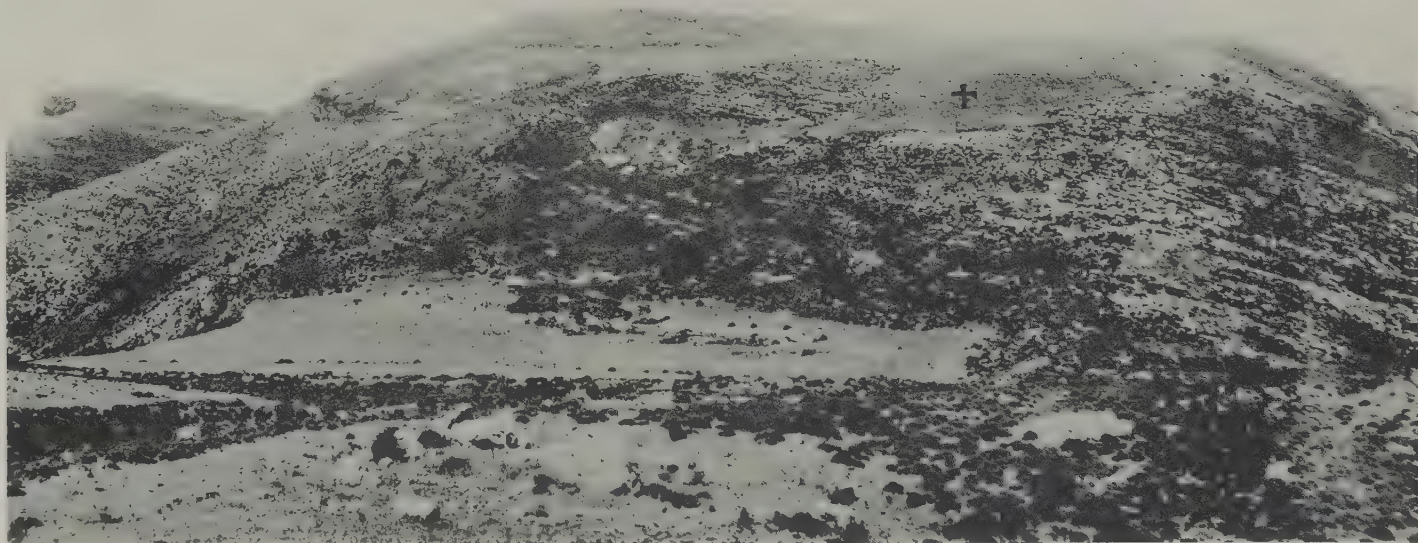
Mugharet Nahaleyeh (north-west of Deishun). No depth of soil; no occupation.

Mugharet-el-Hammam (Wadi Farah), a short distance above Neba Auba. No depth of soil; a few modern sherds.

Mugharet Mejlis (west of Deishun). Rock was reached at 2 m. A few fragments of Bronze Age ware, together with some of Arab type, were found together resting on the rock. Though the cave was probably occupied in the Early Bronze Age, and typical Bronze Age fragments are strewn about the terrace in front, the occupation-debris of this period seems to have been subsequently cleared out.

Abl. A site discovered last year in the Metullah District by the frontier police stationed there may here be mentioned, though it is far outside the district at present under consideration. This site lies in the large open plain which slopes down from the hills south of Metullah to the river Jordan, and its centre would seem to lie some 3 kilos south-east of the village of Abl. Over an area of some 2 kilos square worked flints have been picked up in great numbers; a selection of implements is shown on Plate XXVI, A; they are made from a light yellowish flint and usually covered with a thick dark reddish-brown patination. The predominant form is the *coup-de-poing*; these implements are finely worked and are frequently of the flat ovoid Acheulean type flaked all over both sides, the original skin of the flint nodule is seldom left on the finished implement. Another common type is the circular cutter, fig. c, while small discs, fig. e, and rather roughly worked core scrapers are not infrequent.

A. Map of the Deishun District. (Prehistoric sites ■).

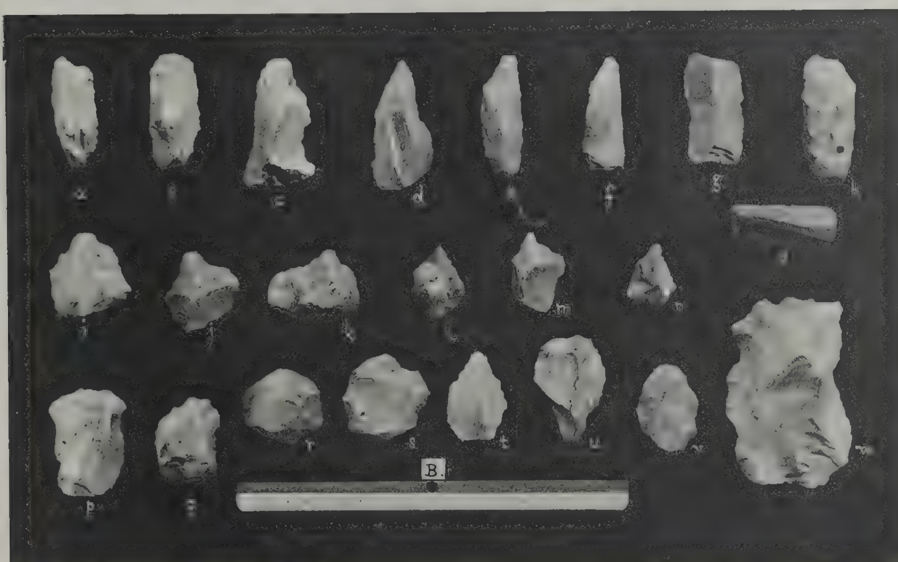


B. View of flint field in Wadi Farah.

The scale on the above illustration is in centimetres

FLINTS FROM THE WADI FARAH.

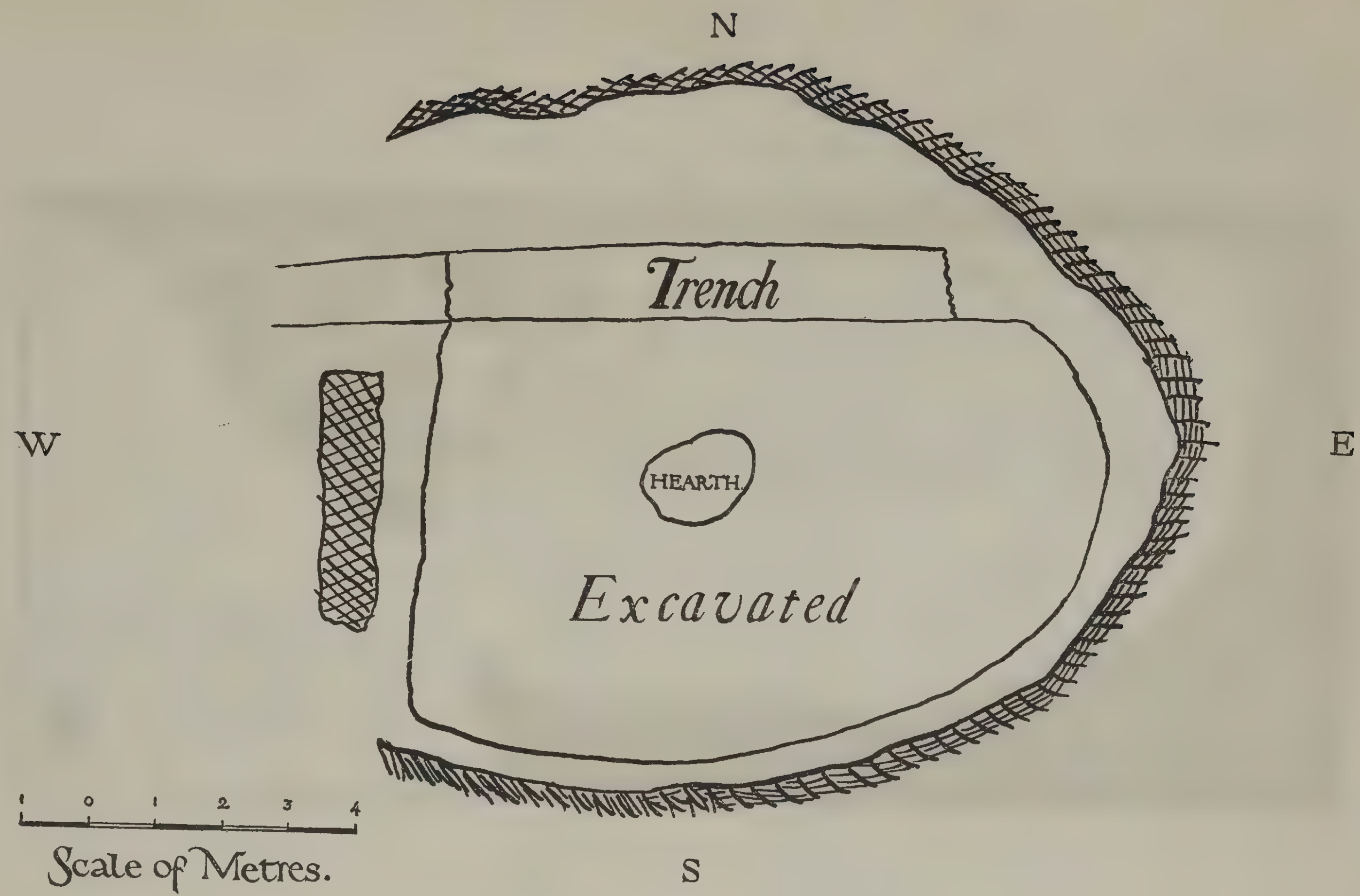
The scale on the above illustration is in centimetres



The scale on the above illustration is in centimetres

(A) FLINTS FROM ‘ABL SITE.

(B) FLINTS FROM SITE EAST OF DEISHUN.

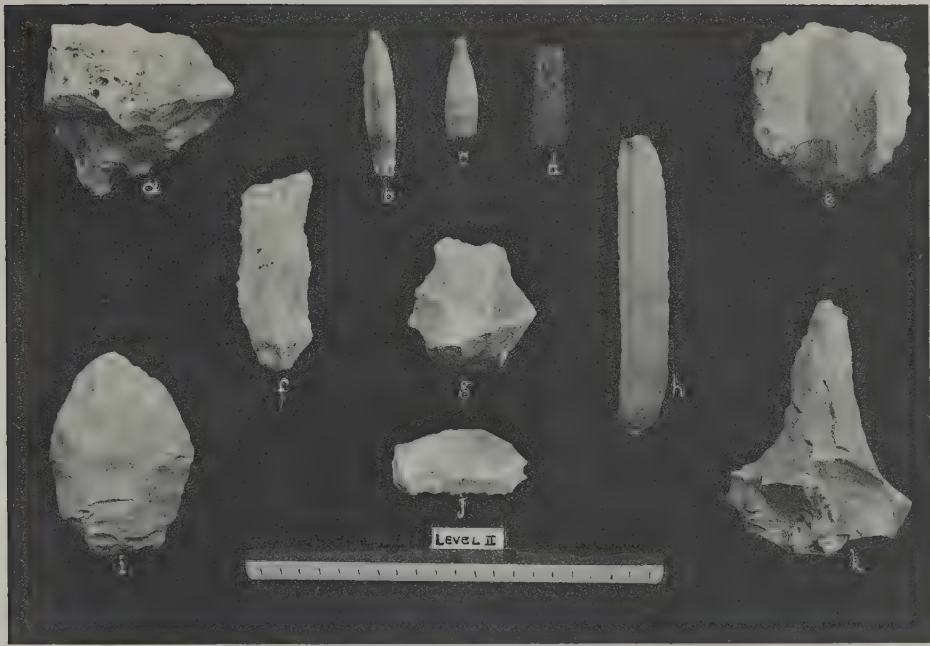


Cave in Wadi Salhah. Ground Plan.

PLATE XXVIII

CAVE IN WADI SALHAH. SECTION.

DRAWINGS OF RECONSTRUCTED POTS AND OF DECORATED FRAGMENTS FROM WADI SALHAH.



The scale on the above illustration is in centimetres

A

The scale on the above illustration is in centimetres

B

FLINTS FROM CAVE IN WADI SALHAH.

(A) LEVEL II.

(B) LEVEL III.

INDEX